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ABSTRACT

The four papers presented in this book are intended to promote awareness of educational applications of microcomputer systems, educational software, telecommunications networks, and cable television. An introduction and a list of contributors precede the papers, which discuss specific topics related to computers and new technologies in education: (1) "Computer Systems for Special Educators," by Kirk Wilson; (2) "Educational Software: In Search of Quality," by Richard Howell, Paul Resta, and Gary Adamson; (3) "Communication/Information Systems for Special Education: The SpecialNet Computer Telecommunications Network," by Gary Snodgrass and Robert Campbell; and (4) "Cable Television: A Medium for Extending and Improving Education," by Judy Smith, Jim Leach, and Charles MacArthur. Each paper addresses three important aspects of its subject, with the history, advantages, and limitations; cost data for each medium is presented first. Availability of materials and future directions are then discussed, and decision-making criteria are provided. Finally, opportunities that the newness of the field present to educators and students are stressed. (Author/LMM)

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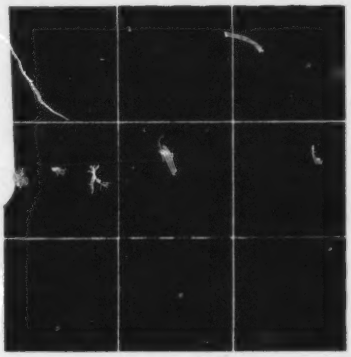

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CONTENTS

Introduction vii

Contributors ix

Computer Systems for Special Educators 1
by Kirk Wilson

Educational Software: In Search of Quality 23
by Richard Howell, Paul Resta & Gary Adamson

Communication/Information Systems for Special Education: 33
The SpecialNet Computer Telecommunications Network
by Gary Snodgrass & Robert Campbell

Cable Television: A Medium for Extending and Improving Education 43
by Judy Smith, Jim Leach & Charles (Skip) MacArthur

INTRODUCTION

The application of electronic technology for instructional, management and communication purposes is not a new concept. What is new is the availability, at an affordable price, of the technology. Educators have been experimenting with various electronic technologies for a number of years; however, the systems of yesterday were often cumbersome and expensive with limited educational applications. An important factor that impeded both the development and acceptance of new technology for the educational community was the attitude of many educators towards the use of electronic machines: Manual systems worked, so why switch? This attitude is now quickly changing.

The education field is maturing in its attitudes towards new communication systems, particularly the microcomputer. Computers are no longer a luxury to be experimented with, but a basic management tool for the successful operation of state education agencies, local school districts, non-profit centers and private programs involved in the education and training of individuals.

Over the past decade, the general public has been sold this technology with astounding success. Newspapers, news magazines, professional journals and specialized publications are filled with articles about personal home computers, software, cable TV and telecommunications systems. The business and general consumer market for computers is solidly established. Now the educational market is ripe. Ten years ago if you attended a Council for Exceptional Children Conference (CEC), you would have found few presentations on the uses of the various technologies in education. At the recent CEC Conference held in Houston, however, short courses on uses of cablevision, computers and educational software, as well as workshops on telecommunication systems were offered. Further, entire conferences are being planned that will target the uses and application of new technologies in education.

HCEEP projects and education programs throughout the country are giving serious consideration to the application of electronic technologies when planning their programs. Administrators are discovering that microcomputers can perform an important role in a program--as a management tool as well as an instructional aid. Data management and overall program evaluation in particular, are becoming highly effective functions of the microcomputer. The variety of software programs on the market today make it possible to do just about "anything." If the right software is not available, a project can contract with an individual or company to have a custom program designed. And the quality, accessibility and communication potential of cable TV make this new educational medium a serious consideration for program planners.

Pre-service and in-service training programs in education are also beginning to require students to take coursework in computer literacy and languages. (Often training programs are conducted through either video or a cable TV station.) School districts are requiring their faculty to become familiar with the uses of computers and the existing software. Entire states are being electronically connected via telecommunication systems. In short, the "electronic era" is upon us.

The purpose of this publication is to promote current awareness of educational applications of microcomputer systems, educational software, telecommunication networks and cable television. Granted, there is a proliferation of information on the market. Yet it is often confusing, certainly at times misleading and definitely not written with the special or regular educator in mind. This book should fill the gap in available literature. The authors are professionals working with the education field and writing with the specific needs of educators in mind.

Throughout the chapters of this book, the educator is presented with three important aspects of each subject. The history, advantages and limitations, and cost data for each medium are discussed. Second, the availability of materials, future directions and decision-making criteria are provided. Third, and most important, all the authors stress the opportunities that the newness of this field present. Educators and students are a large market and can change the type and quality of software available and the quality of educational programming that is beamed into your television set. Educators can enter this field at an opportune moment--just when it is developing.

What follows in this publication is information that will serve to educate the reader on the developments, applications and issues of electronic technology in the education field. WESTAR wishes to express its sincere appreciation to all of the contributors for their time, talent and patience in completing this publication.

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COMPUTER SYSTEMS FOR SPECIAL EDUCATORS

Kirk Wilson

Computers are now being used in practically all of the 16,000 school districts in the United States, primarily for standard applications such as accounting and student scheduling but also for a growing number of unique applications in special education. The growth in educational computing for instruction and administration has been dramatic. In terms of "hardware," 70,000 educational computers were purchased in 1981; in 1985 it is projected that 270,000 will be purchased.

This paper is designed to help special education administrators who are thinking about adopting a computer system as an aid to program management. It outlines the basic stages involved in selecting and implementing a system and describes the pitfalls and key decisions of each stage. The decisions are not simple ones; they must be based on thoughtful planning and a realistic understanding of the issues involved.

Getting Ready

The first stage, that of Getting Ready, begins with reducing your intimidation of computer technology and learning to persist in asking basic questions until you get an answer that is understandable. You should review your current job responsibilities and the way you complete your various tasks, in order to gain an understanding of your information needs. Making a list of the typical questions you must address in your work, including data needs and instructional/case management questions is the first step. Some examples might be:

- What is the mean and median load of your case therapists?
- With which agency is each special education student involved?
- What is the average hourly cost for each piece of equipment based on student/teacher use, initial purchase price and repair cost?

Once you have outlined the typical questions which you address in your work, you can review the list and specify how difficult it is for you to answer each question and for which questions immediate and accurate answers are most important. You should go over the list again and make estimates of which tasks are amenable to computer-based support. For each question you may then estimate whether you think it will be Probable, Possible or Impossible for a computer to help you find an answer. Below are examples of questions and estimates regarding question difficulty and potential for computer support.

> EASY to answer and PROBABLE for a computer to provide support: What is the name, handicap, native language, ethnicity, economic status and school placement of each student in our program sorted alphabetically, grouped and subtotaled by handicap, native language and school placement?

EASY to answer and POSSIBLE for a computer to provide support: In what areas are we in compliance with state and federal regulations?

EASY to answer and IMPOSSIBLE for a computer to provide support: Are appropriate teaching and resource personnel available within the program?

MODERATELY DIFFICULT to answser and PROBABLE for a computer to provide support: What are the primary and secondary sources of financial support and how have they varied over the past ten years?

MODERATELY DIFFICULT to answer and POSSIBLE for a computer to provide support: How might legal services be used in proactive/preventative steps?

MODERATELY DIFFICULT to answer and IMPOSSIBLE for a computer to provide support: In what way is the organizational structure reflective of current operations?

DIFFICULT to answer and PROBABLE for a computer to provide support: Given both enrollment trends and budget trends over the past five years, what are the projected budget figures for each main category over the next five years?

DIFFICULT to answer and POSSIBLE for a computer to provide support: What are the projected personnel needs for next year based upon projected student enrollment, distribution of students by handicap and staff-turnover?

DIFFICULT to answer and POSSIBLE for a computer to provide support: What are the projected personnel needs for next year based upon projected student enrollment, distribution of students by handicap and staff-turnover?

DIFFICULT to answer and IMPOSSIBLE for a computer to provide support: To what extent is the evaluation process reflective of the differential assignments among administrative personnel?

You should keep in mind, when considering all of the above, that it cannot be stressed enough that computers do not organize special education programs; people do. If your program is disorganized, a computer implementation of it will also be disorganized (and with more disastrous consequences). The benefit of even starting to plan a computerized special education system is that you are forced to explicitly define program procedures, and even if the computer system never becomes established, your special education management will have clearer goals and evaluation criteria.

After completing your initial analysis, the next step is to begin talking with people who have experience with computers and to acquire some hands-on experience yourself. Talk to colleagues with computer experience about the kinds of software they are using and listen very carefully to their advice. Table 1 provides a list of standard educational applications of computers in administration; Table 2 provides a list of specific applications for special educators.

Table 1

Standard Applications of Computers in Educational Administration

- Class scheduling
- Grade reporting
- Test scoring
- Attendance
- Personnel record-keeping
- Accounting for income, expenses and balance sheet accounts
- Accounts payable
- Billing for tuition, therapy and transportation
- Payroll
- Budget planning and reporting
- Inventory
- Word processing for correspondence and proposal preparation
- Mailing lists and personalized mailings
- Generalized data base management

Table 2

Specific Applications of Computers in Special Education

- Counts of students screened, assessed, placed and reviewed
- Reimbursement computation according to state and federal formulas
- Generalization of standard local, state and federal reports
- Reports of student due process status and compliance with P.L. 94-142
- Child counts cross-referenced by class, teacher, school and handicap
- Reports on student achievement and evaluation status
- Detailed records and summaries of diagnostic testing
- Personalized mailings to parents regarding IEP and review meetings
- Lists of incomplete information on student records
- Audit trails for program placement and review
- Interactive creation of IEP goals and objecives from curriculum files
- Generation of quarterly student reports
- Recommending appropriate activities for students
- Locating learning materials
- Describing diagnostic materials
- Reminders when notices are due or should be sent out
- Maintaining information on health history and special medication
- Electronic mail
- Interactive access to related service information, e.g., transportation
- Financial planning programs for "what if" analysis and budget planning

A wide range of instructional and administrative software is available for the Apple II microcomputer. Photo courtesy of Apple Computer.

If you have never used a computer before, the best way to get acquainted is by sitting down at a computer keyboard with a patient and friendly person and running a computer program. YOU should do everything from turning the computer on to turning it off. It is surprising how much more you learn and how many more questions you need answered when you are doing the typing and making the decisions as opposed to when you are looking over someone's shoulder at a computer demonstration.

Once you have observed what one or two computer programs can do, you will have basic reference points for how computers operate and you will begin to ask both general questions and questions specific to your own needs. As you ask questions related more to your own needs, you will find it harder and harder to find someone with the answers. Or you may find that people are offering answers of which you might justifiably be suspicious.

You should try to locate one or more friendly technical people who can be your personal "computer guru" to explain the basics of computers. This may be a fellow staff member, the director of the computer center in your school district, a parent of one of your students, one of your students, a graduate student or faculty member from a local university, a computer dealer or a member of a local computer club. Most urban areas have at least one computer users' organization which meets monthly; the Boston Computer Society, for example, has special interest groups for nine different personal computers as well as seven additional groups focusing on Business, Education, the LOGO educational programming language, Robotics and others.

Initial Expectations

If one major task in the Getting Ready Stage is to become oriented to the basic capabilities of computer hardware, the Initial Expectations Stage will be dominated by the realities of using computer programs or software. If you have a good understanding of the kinds of computer support you are looking for, the next step is to locate software that meets these needs and "experience" them. If none of the software that you can find is satisfactory, you may then consider arranging to have custom software written to meet your specific needs. (The advantages and disadvantages of each will be discussed in The Design Issues Stage.)

The major issues or activities in the Initial Expectations Stage have to do with: Understanding software and its application to your needs; Estimating how the current work style of you and your staff would be affected by a computer support system; Realizing the various problems and risks of introducing a computer support system; Projecting the various new expenses as well as cost-savings associated with computer use; Adjusting initial expectations with the limitations of computer systems; and Becoming a member of formal or informal groups working with computers in special education.

Understanding software and its application to your needs. Selecting appropriate software for the application you have in mind is one of the most difficult aspects of implementing a computer system. It is easy to determine whether a particular software is appropriate for the most standard applications, e.g., word processing, general ledger accounting, payroll. For more specific applications, however, written descriptions are not sufficient; and even a copy of the user's manual or software documentation will often not be enough. The best option is to "test-drive" the software on a 30-day return basis or to talk with someone who is using it. The more specific it is, the less likely there will be someone local who can demonstrate its use and the more difficult your task will be. As a general rule, the more sophisticated and flexible the program is, the longer it will take you to learn its capabilities. (This does not mean, however, that a powerful program should be difficult to install or use on the first day; good software will help you get started quickly and will reveal more capabilities as you become ready for new applications.)

Over the past couple of years there has been sharply increasing interest among educational organizations to provide software or courseware evaluations. The Northwest Regional Education Laboratory (300 S.W. 6th Avenue, Portland, OR 97204, 503/248-6800) has recently been funded to develop the MicroSIFT Project; their initial goal is to develop and maintain a nation-wide information base on 1) producers of software, 2) software packages, 3) resources for computer literacy training, 4) computers installed in schools, and 5) research projects involving computers in education. The publishers of Learning, a national publication with some 270,000 subscribers, has initiated The Learning Computer Sortware Awards (530 University

Ave., Palo Alto, CA 94301, 415/321-1770) in which a broad range of educational software will be evaluated and described in Learning, Curriculum Product Review and Educational Dealer. On a more regional level, the Western Center for Microcomputers in Special Education (1259 El Camino Real, Suite 275, Menlo Park, CA 94025, 415/326-6997) has been formed "to interpret, clarify, and communicate to special education users the latest microcomputer research, development, products and applications." Each of these organizations can help you find software to meet your needs.

Estimating how the current work style of you and your staff would be affected by a computer support system. The introduction of computers into a traditional office environment will be successful to the extent that it is perceived by each individual user as a genuine support system and not as an administrative innovation to serve the interests of the chief administrator. If you have never introduced a computer system to people who have not used a computer before, you will underestimate by a factor of three to ten the period of time necessary to get the system working smoothly and routinely. The first few months are the most critical. The first six months to a year will usually determine the attitude your staff will take toward the computer and its usefulness. The best policy is to plan a step-wise introduction of the computer and make sure everyone has an opportunity to comment on its usefulness to them. Even if they do not get great benefit from the system, it is important that they feel it is "theirs".

The most chalienging task is to attempt to implement an existing management information system developed over time or which has been introduced to the district as an integrated system. For example, the CASE (Comprehensive Assessment and Service Evaluation) Information System developed by the American Speech, Language and Hearing Association is a comprehensive planning and management system for speech and language therapy professionals (Snope, Duran, & Dublinske, 1981). If such a system were in use, or partially in use, in your special education program,staff expectations would be much higher since there are many obvious ways in which a computerized CASE system would be an improvement over the current manual one. Such an effort would also require that the software system be user-definable rather than fixed format, since the CASE system can take a variety of forms depending upon the type of evaluation or treatment facility in which it is used.

At a minimum, a plan should be drawn up outlining what types of support the computer system would provide to each staff member (certainly some may not use it at all), along with estimations of each staff member's microcomputer or terminal access time and the kinds of information to be managed.

Realizing the various problems and risks of introducing a computer support system. There are several potential risks involved with introducing a new computer support system into a special education program. If it replaces central office services, there may be lingering resentment from the computer center staff. Risks come in making promises which are unrealistic and in attempting to introduce the computer system without a period of testing to show the software is functioning as expected. (The more powerful and flexible the software, the longer it will take for staff to take advantage of its special capabilities.) Additionally, first-time computer users are usually relatively unforgiving with faulty equipment, although they become more tolerant as they gain experience (computers do break!).

The greatest long-term risks arise if the system is not established as an integral part of the special education program. However, if it does not ignore any segment of the special education staff, the prospects for smooth operation of the system will be good.

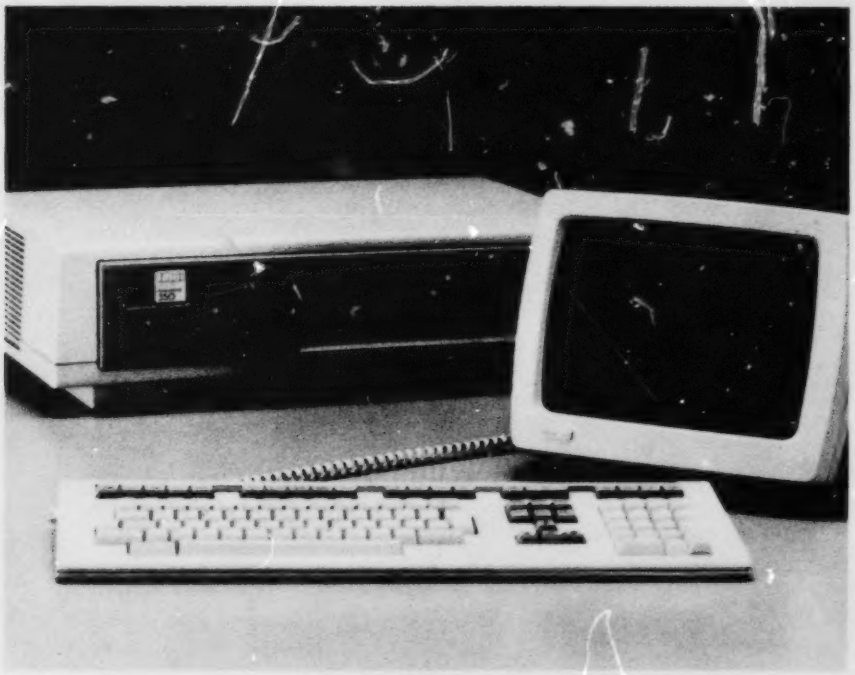
Projecting the various new expenses as well as cost-savings associated with computer use. It is not difficult to determine approximately how much staff time is saved when using a computer for such tasks as class scheduling, billing or word processing. In other cases, the comparison may be moot. If you can find any item of information in a 75-page computer file in less than 5 seconds, and the same task takes 5 to 15 minutes searching through a standard manila file folder, the reality is that computer use will become routine. The factor which cannot easily be computed is the qualitative effect of computer technology on an educational program. If administrators spend 70% less time working on reports and 70% more time planning program services, how can this be effectively described?

To argue convincingly for computer cost-effectiveness, it is important that all costs are recorded and prorated over a multi-year period. There are obvious computer costs and there are hidden costs. The obvious ones are for purchase or lease of hardware or software. Costs for annual maintenance contracts, leased telephone lines,computer diskettes or disk packs and paper are easy to track. The more elusive costs are those which are often included within other budget items.

The time required to train staff, research new software, administer the computer operations and set things straight when hardware or software do not operate properly must all be accounted for as costs or a portion of a salary. A budget must also be evaluated in terms of fixed versus non-fixed costs over a multi-year period. Fixed costs are those which are constant over a one-year period or which increase by some constant inflation factor. Examples of fixed costs are purchase of hardware and software, salaries for computer personnel and telephone or leased line communications. Non-fixed costs include contracts for custom programming (they are not as fixed as they may appear) and telephone charges for dial-up access.

Adjusting initial expectations to the limitations of computer systems. During the first months or year in using a particular system, you will become increasingly aware of the limitations of your computer system. There will be some tasks which the program simply cannot do and others which are limited by the capabilities of the computer, the disk drives or other technical aspects of computer operation. The most critical limitations will usually be in the software; the program just will not do enough, or it will not be transferable to another machine or computer environment. For example, you may use a program which allows you to store no more than 100 items of information per student. While you may have started with a data base of 50 items per student, you might eventually find yourself bumping up against this 100 item limit. If you have adjusted to this limitation, you may have reached the point where you want to use a more powerful storage device, one that stores 20,000,000 characters of information instead of your current 200,000. It might be that you would now find out that your current program can not be used with the larger storage device as it was designed for the smaller disk drives. Because there are so many possible sources of frustration or limitation, your best strategy will be to ask your various "computer gurus" to speculate on worst case scenarios one, two or three years hence given the configuration of your initial computer system.

Becoming a member of formal or informal groups working with computers in special education. Given the increasing numbers of meetings and conferences focusing on computer applications in special education, you should certainly plan to attend at least one such meeting. These conferences are usually organized by existing special education organizations on the national or regional level and tend to have a consumer perspective. At the same time you should plan to attend one of the more technically-oriented conferences dealing with networking, videodiscs or some other rapidly developing computer technology. It is a good idea to know what is around the technology corner to keep yourself open to new applications which may expand your current system.



The recently announced Professional 350 compute from Digital Equipment Corporation includes an advanced user interface and the capability to process several tasks simultaneously. Photo courtesy and copyright of Digital Equipment Corporation.

Initial Decisions...Design Issues

Initial decisions about computerization are extremely important and are all too frequently made without a sufficiently broad or long-range plan. Unfortunately, they are extremely difficult decisions to make. Once you decide the basic features of the computer software (and then hardware, not vice-versa!), you immediately close off options so that future decisions are much easier to make. It is also true that the decision-making process that is established in the early stages is probably the same one that will be maintained as additional questions need to be answered about how to modify or enhance the use of the computer. Now is when you must take your time and consider the advice of not only your entire staff but as many management and computer experts as possible. Making decisions about basic design issues should be another trial-by-fire for you and if it is not, you have simply not considered all the options.

The major issues in the initial decisions stage are the most technical of any stage. They are discussed below.

Flexibility vs. rigidity. Computers act upon information in a variety of ways. The programs which enable these actions may be designed to allow different styles for each of these actions or may function very rigidly, offering only one option at points where a more flexible program will provide many. Table 3 lists some of the major functions of computers; for each function an example is given of flexibility (user-definability) and rigidity (where only single options are provided at potential decision points).

Table 3

Major Functions of Computers with Flexible and Rigid Software Implementations

	FLEXIBLE APPROACH	RIGID APPROACH
Create	Varied file structure	Single file structure
Edit	Modify any item	Delete and re-enter entire item
Store	Small or very large files	Single file size
Reorganize	Simple file modification	Cannot reorganize files
Format	Change display/print	Cannot change display/print
Graph	Varied visual display	Simple bar charts
Sort	Sort on any type of info	Sort on fixed set of info
Filter	Extract subset of info	Cannot extract any subset
Transfer	Move info file-to-file	Cannot move to another file
Mail	Can send info over phone	Can send in limited way
Print	Prints in varied ways	Prints fixed format, one printer
Teach	Teachers/helps new users	Requires reading manual
Simulate	Demonstrates principles	Cannot demonstrate principles
Program	Users can enhance	Users cannot change operation
Problem-solve	Answers "what if " questions	Answers fixed set of questions
Drill-practice	Provides variety	Unimaginative repetition

Dynamic vs. fixed format information storage. A major feature of any computer information storage and retrieval system is the structuring of information in files. A dynamic system lets you start creating information and does not need so much advance warning of the ultimate structure or size of the information. A fixed format system needs to know exactly what will be stored and how much. The dynamic system lets you easily add new information or restructure the file. A fixed storage system is not easy to modify, and when it can be modified, usually requires more than passing knowledge of how computers store information.

Computer files, whether of the dynamic or fixed type, usually consist of "records" with fixed or preformatted files. Each record will have subelements called "fields." The dynamic file offers the advantage of only storing as much information as you enter into the file. The fixed file structure will allocate the maximum storage on, for example, a disk drive; and if you store only ten per cent of what you expected, the file still occupies the maximum storage. As a practical example, the dynamic file allows a psychologist to enter a variable length comment on a diagnostic test; the comment may be five words or, with dynamically allocated storate, five hundred. With a fixed file system, you predetermine a set space for comments; and if that is 100 characters or twenty words, it is not possible to enter any more.

System integration. The ideal software/hardware system answers all of your questions. It exchanges information between all of its subprograms. It can be "interfaced" easily with new programs which you install on your computer. It is easy to understand and to use. And as you might guess, this ideal system does not exist. The software continuum seems to swing between thorough single-purpose programs and less thorough but more comprehenisve programs which attempt to integrate various functions.

On both theoretical and practical levels, it is difficult to design a system which evaluates a student's capabilities, reports the evaluation information to a prescriptive program, suggests activities for the student, cooperates with a teacher to plan instruction, reports to the administrator the relevant aspects of the student's needs and progress, summarizes various aspects of the student population, analyzes program functioning within a budget model, allows administrators to use existing data with projective techniques and so on. Moreover, computer systems which prescribe invariably conflict with the judgement of teachers, since after all, the computers design for prescription is based on some human computer designer's model of how instruction should proceed.

User-definability. All programs will have menus of some sort to show you what options you have to carry out the major functions of the computer. A user-definable system will have a long list of options and will even let you change the list of items in the menu. For example, a user-definable software might display five different report formats, but would include options for you to specify what information should be reported and how it should appear on the screen. You may also have considerable flexibility in how the computer displays information. Finally, you may speed the way in which information is entered. For example, for each item stored by the Teacher Planning System (Wilson & Beinashowitz, 1982) it is possible to store a user-defined menu. And if you want to enter the language spoken by a student's parents into an item labeled "Language Spoken At Home" (also user-defined!), the computer will display the following:

```
Select one:
E(nglish        G(reek
S(panish        I(talian
C(hinese        V(ietnamese
F(rench         O(ther
R(ussian
```

You may then type the first letter of the appropriate language to indicate the language spoken at home, or type "O" for "other" and enter a language not in the list. Using such user-defined menus, input is quick, spelling errors are minimized and beginning users are guided to appropriate responses.

Direct access vs. service bureau. The introduction of personal computers has made it possible to have your own computer resources, to "talk" directly to your own data base and to interactively define reports and graphic displays. The direct access approach is becoming the standard mode of operation for all computers except for the most common repetitive operations such as payroll and other standard procedures. Using computers directly does require time, familiarity and, of course, a computer or terminal which you may use at a time convenient for your schedule. The alternative to doing it yourself is to use another computer resource which has standard modes of operation; this may be the data processing center in your school district, or it may be a commercial computer operation. While the data processing center provides a definite service and frees you from technical details, it does so at the expense of flexibility. You typically cannot specify reports as you would like them to appear, and the turn-around time can vary from days to months. Deciding whether to go with direct access or a service bureau requires analysis of current procedures and discussions with colleagues who have followed both approaches.

Custom software vs. off-the-shelf software. Custom software has the advantage of addressing the peculiarities of your own requirements, and has the risks associated with locating an individual or organization to develop the software as YOU want it and to maintain it from year to year. (Software maintenance means repairing obvious or obscure "bugs" and also introducing new capabilities as the need arises.) While an existing software package may not meet all your needs, it usually has a fixed price and you can determine its performance by a demonstration or a trial use period. Custom software, on the other hand, offers a promise to meet your needs; but the ultimate cost and performance cannot be determined until after an investment in time and money has been made.

There is no easy way to decide between custom or off-the-shelf software. You must evaluate the ability of your staff to implement custom software and off-the-shelf software and its unique ability to address your unique needs. You should keep in mind that good software is continually improved, and if the custom software approach is followed, there should be at least a multi-year commitment to modify it as new needs are specified.

Top-down administrative design or bottom-up staff-oriented design. Most special education computer systems have a top-down design; that is, they are refined by administrators. In contrast, a bottom-up design will address the needs of those who work directly with students and provide them with computer resources; they will perceive the computer to be "their" tool. The benefit of a bottom-up design is that data maintained at the most child-specific level can be automatically transferred up to higher administrative levels, removing the need for data sheets to be completed and returned to the central office. The liability of a bottom-up design is that interactive computer resources must be provided to a wider range of staff.

A service bureau approach may be adopted with a bottom-up perspective, but it leads to problems in transferring large amounts of printed information among people and eventually to the data input staff. (If many special education staff have direct access to computing resources, the input-access-reporting responsibilities are also distributed.)

Portability and user interchange. When technical people refer to portability, they are not referring to how easy it is to carry a microcomputer (though this can be an interesting issue), but rather how easy it is to run a particular program on different computers. In contrast to BASIC, Fortran and Assembly language, second generation microcomputer languages (e.g., UCSD-Pascal, ADA, Modula and C) produce "code" which may often be run without modification on many different computers. This means not only that you have considerable flexibility in initial hardware purchase but that introduction of new computers will not make your software obsolete.

Software should also be designed to encourage its users to exchange data bases. The Curriculum Management System (Wilson & Beinashowitz, 1981) allows users to freely share all or part of a curriculum, for example, one can copy goals from one curriculum on teaching math with an abacus into a second curriculum under development for visually-impaired children.

Simplicity of the human-computer interface. The human-computer interface will be the most important issue in the marketing of computers in the 1980's. The interface is the computer software which lets you control the computer, understand what it displays on the screen or on paper and understand what the computer is currently doing or trying to do. In developing very flexible software systems, designing the human-computer interface is like teaching someone how to put on a tie via a telephone conversation. Table 4 gives an example of the basic principles guiding one of the most recent approaches (Irby, Bergensteinsson, Moran, Newman, & Tesler, 1977; Moran, 1981).

Table 4

Basic Principles of the Xerox Star Human-Computer Interface

Familiar Conceptual Model: the designers have adopted a metaphor of the computer screen as desktop; you move small graphic screen images of files to other images of "out-boxes" (to transfer completed work to another person), or a "printer" (to print a file) or a "wastebasket" (to remove a file).

Seeing and Pointing Versus Remembering and Typing: a software system should be aware of all options available to you and provide a simple means, e.g., the Xerox "mouse" input device; most users will be significantly hampered if they must remember the full range of commands and enter them on a keyboard.

What You See is What You Get: each time you enter a command, the computer should indicate the effect of the command by reorganizing the display or in some other way communicating the effect of the command; it is very disconcerting to execute a command and not know how or whether it has taken effect.

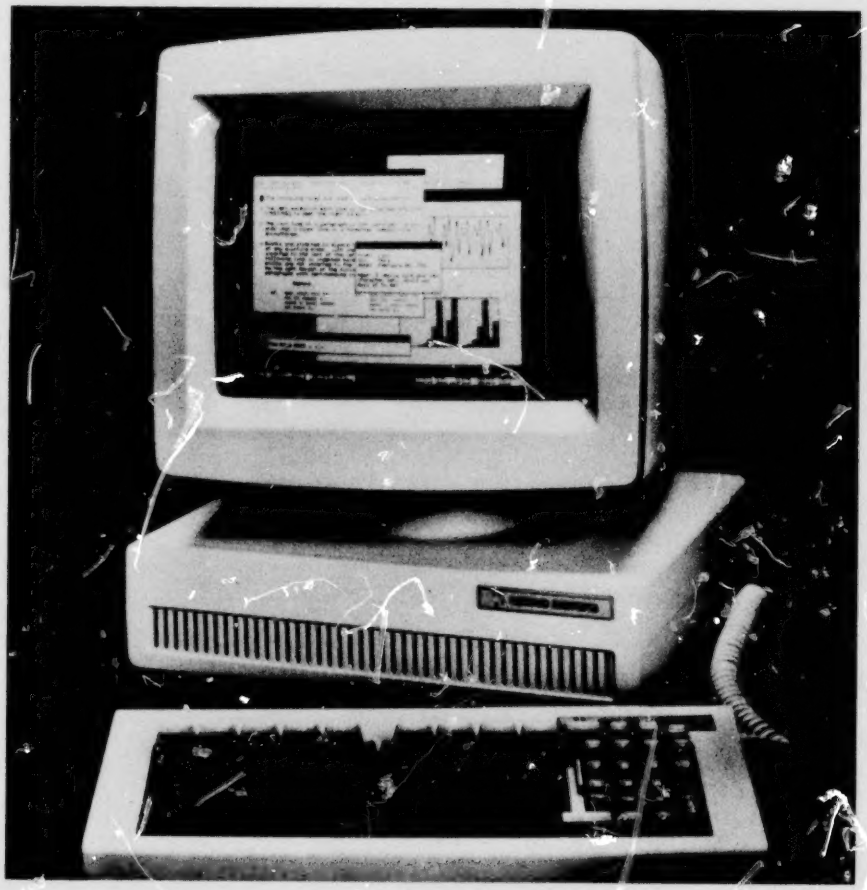
Universal Commands: a common set of commands should be used throughout a program, minimizing the number of commands to be learned and simplifying the operation of the system.

Consistency: each command should have a single well-defined function.

Simplicity: the basic level of operation should be made up of a core of commands; additional commands or sub-commands to the core commands should be available with "progressive disclosure" (hiding complexity until it is needed).

Modeless Interaction: the command language should minimize changes in mode; for example, word processing using the Xerox Star MIT-EMACS, Logo, and Mince does not have separate insert, delete and movement modes as in most current editors; with a modeless editor you are always in insert mode.

User Tailorability: a program should ideally allow personalization of all its functions to the particular style of each user; state-of-the-art software systems allow users to set up "profiles" so that each time the system is used, it is automatically configured to the particular tastes of the user.



Corvus Systems offer hard disk storage microcomputer networking and the Corvus Concept, a new-generation personal work station. Photo courtesy of Corvus Systems.

Implementation...Making Compromises

The Implementation Stage is when you really discover exactly what the computer can do, and it typically will be somewhat less than the expectations you had built up. The computer system might require more storage than you had anticipated, so that instead of storing 400 items of information per student, you resolve to store only 75. The cost of connecting 10 terminals to the offices of each supervisor in your county-wide program may result in telephone costs that exceed the budgeted amount; you might need to change from leased telephone lines which give you fast transmission (240 characters per second) to slower regular acoustic phone lines (30 characters per second) which are connected to the main computer by dialing up each time the terminal is to be used. You may find that some standard reports simply cannot be generated and others only at intervals of every three months, rather than the three-week intervals you had expected.

Once the system is installed, your staff is trained and some routines are established, you will begin to think about enhancements and how to make the entire system run more smoothly. If you use the system yourself, you will keep a mental list of enhancements and, particularly if you are using a microcomputer-based system, you will become connected to a "grapevine" with constant rumors about new software and related products. The major issues in the implementation stage are discussed below.

Developing a plan including system specification, sequence of implementation, staff training, testing and final review. Initial planning will be modified by realities of the allocated budget, pressures to get a system "up and running" and the specifics of adjusting the software to existing procedures. It is always helpful to develop a systems specification document which can be edited and refined as the system reaches initial completion. This will guide those who direct installation and will also inform all interested parties (administration, teaching staff, parents, others) of the goals of the system and how it will address their needs. The following sample questions might be answered in a general system specification: What will the computer-based special education support system do? Who will use the system? How long will it take to do each task? How will the system be improved later on to do more? Clear non-technical answers to these questions will elicit useful feedback from staff members and will ensure that no one misunderstands the objectives for the first implementation.

On the technical side, the ideal is to have a trained person who is not developing your system serve as a representative or ombudsman to verify that technical progress and complete software documentation are being maintained. The technical person should be able to answer your basic questions. The plan developed at this time should also include staff training, testing and final review.

Deciding whether to manage the computer system with in-house computer staff, with contracted resources or with your own special education staff. Deciding who will develop or maintain your computer hardware/software is a complex process. It will be affected by many factors: your own and your staff's orientation to technology, your staffing structure in terms of ability to assume new assignments, the short- and long-term budget capabilities, availability of other technical and computer resources, the extent to which you want control over your own computerized information, your willingness to become dependent on computer technology. Given three basic approaches, there are advantages and risks with each:

a) Contracted computer services. ADVANTAGES--burden for performance is shifted to external organization; contractor may have previous experience in managing special education programs; costs for computer operations are explicit in contractor billing; contractor will implement custom features of software; software system may already exist in field-tested, fully-debugged form. DISADVANTAGES--design and control of system is outside of special education program; contractor may impose a software design that does not conform to the program; software may not be flexible enough to meet unique needs; contractor may not have experience in special education; contractor costs for custom programming may be high, including required leasing of software and hardware; contractor may require purchase or lease of specific equipment without flexibility to use current school district equipment or equipment which may be used for other administrative or educational purposes.

b) Central in-house computer system. ADVANTAGES--easy access to computer center staff; leverage on computer center via superintendent or other administrative official; costs for computer operations may not be charged to special education program; custom programming is possible at relatively low cost; improvements in computer system will not be charged to special education. DISADVANTAGES--Computer center staff may not complete work in timely fashion; computer center staff may change; other school district tasks may take priority; computer center may not provide adequate direct access to computer system; computer center staff may want excessive control over the implementation.

c) Your own special education computer system. ADVANTAGES--special education staff will have direct access to computer resources for report generation; costs may be fixed and explicit; microcomputers and networking systems are low cost and general purpose; staff determines enhancements and sequence of implementation; easy-to-use off-the-shelf software exists for special education management. DISADVANTAGES--special education staff must assume responsibility for initial planning; staff may not support use of computer system; the computer system may not perform as expected; other school departments may adopt incompatible systems; the special education system may overlap with existing computer services in school district.

Selecting optimal hardware based upon the software requirements. The hardware configuration that is best for you will be determined by: requirements of existing software or software to be developed, existing computer systems with which your computer should be compatible, upgrading options (such as increased memory, larger storage devices, faster or higher quality printers and so on) and long-range planning. Software which operates on a variety of computers, operating systems and networks offer flexibility in terms of graduating to more powerful computers or networking systems. If the software to be used can only run on one computer or one computer operating system or in conjunction with a particular terminal, then there are not many decisions to be made (the decisions have been made for you).

The current trend in many areas of computer system development is toward networking and distributed processing. A network of personal computers may each share access to large storage (80-200 million characters hard disk storage as opposed to 300,000 characters on floppy disks). Distributed processing means that both smaller/slower computers and larger/faster computers may exist on the same network where each carries out the tasks for which it is best suited.

Introducing the system to your staff and establishing realistic expectations for the support that the system will provide them. If your staff has been involved in the planning and specification of your software/hardware system, introducing the system to them when it is finally installed will be a smooth and straightforward task. If the staff has not been part of the planning process, then it is important to clarify the purpose of the computer system, its advantages over existing procedures and the personal benefits that each staff member may gain from it. Staff members will be anxious about using a computer for a variety of reasons, so their specific responsibilities must be spelled out very clearly, and they must have an opportunity to get over their initial fears--ideally by using the computer in demonstration sessions.

It is essential to structure a pilot phase during which individual staff members have an opportunity to test the programs and comment on how current procedures need to be adapted. If changes in office procedures occur without planning, various frustrations will emerge and the

pace of the implementation will be slowed. If the system has been introduced to improve administrative reporting capabilities without any direct benefit to those maintaining the various data bases, procedures will need to be established to monitor the accuracy and completeness of the data.

Determining the life cycle of the software and hardware. The introduction of a computer system is the first of a series of phases that you will go through in improving your information management system. Any feature of a system may undergo change. You may decide, for example, to add telecommunication capabilities or enhance the human-computer interface component as new technologies become available.

For various reasons you will eventually outgrow your initial hardware and (perish the thought:) the initial software as well. Usually when either the hardware or software begins to become inadequate, the other should also be re-evaluated. The re-evaluation is made in terms of cost-effectiveness and of the success of the entire system in meeting the needs of special education staff. To the extent that you can project the life cycle of the initial hardware/software, you can be more realistic in reporting the cost-effectiveness of the system and in planning future purchases.

Planning interfacing to other computer systems for data exchange or update purposes. With the exception of electronic mail, few computer systems in education enable routine direct computer-to-computer transfer of student, budget or other types of data. The transfer and sharing of non-confidential information is becoming an increasingly useful application of computers, however; and even if this capability is not introduced in your first system, there should definitely be provision for it in your list of enhancements. Exchange of data may occur via telephone line transmission or via mail delivery of computer tapes. The range of information which may be usefully exchanged ranges from budget models to curricula specially designed for handicapped students. For example, CMSNet, the Curriculum Management System Exchange Network (Wilson & Beinashowitz, 1981), is being implemented to allow free sharing of computer-based curricula in special education, basic skills and vocational education. Users may copy an entire curriculum or selectively copy sections, goals or objectives into their own curricula.

If it is recorded in the appropriate form, data from many sources can be integrated into a central data base. For instance, the Sioux Falls Public School System (Sioux Falls, South Dakota) is designing a computer-to-computer updating system. Each night between 1:00 and 4:00 a.m. the central office computer system will call up microcomputers located at each school and collect any new teacher-entered information which should be added to administrative files. This communication facility will be added to the already password-protected Teacher Planning System student information data base.

Integrating the Computer System into Special Education

Even after a full year's operation, a computer support system may not be fully integrated into the administrative and instructional management procedures that are at the core of the special education program; it might still be possible to remove the computer and function quite adequately without it.

The Integration Stage is the longest and most important in determining whether a computer system for special education management has succeeded or failed. During this stage, mismatches may emerge between the computer system and administrative or program needs.

Such a mismatch may stem either from previously existing structures or from changes in program. There can be several consequences: procedures can be changed to accomodate the computer system; the staff may reject, ignore or sabotage the system; procedures can be changed to accomodate the computer system; or, in the case of flexible software, the software itself can be modified. (Rigid software will gradually go out of use and be replaced with a newer computer system or even a return to manual operations.)

The major issues in this stage are discussed below.

Determining the structure of the student data base. The important feature of the initial structuring of student information to be maintained on the computer is that it is initial. While the structure of the information will not change on a daily basis, there should be provisions in the software system to modify it conveniently and without extensive technical training. At a minimum, the software should provide storage of student identification, educational services, instructional program and a full-range of diagnostic information. Staff should be able to enter extensive comments on student performance or diagnostic test results. Instructional planning and evaluation information should be either cross-indexed to curriculum files or personalized and inserted in the student file. Access to the instructional component of each student record should provide simultaneous access to student goals/skills, objectives, teaching strategies, activities, materials, criterion-referenced tests and so on. Some items or records in the student file should be automatically computed, e.g., current student age. Finally, if a budget model for individualized student services can be designed consistent with the administrative procedures of the regular and special education programs, all educational services should be associated with unit costs for service delivery. And if the data base is integrated into a central system, appropriate provisions must be made for updating.

The software for managing individual student records should also be applicable for managing staff data--including information about certification, evaluations, teaching experience, placements, merit pay and so on.

Deciding who "owns" the system and training the staff who will use it. It is important that all staff who use the computer have an understanding of who "owns" it and, of the extent to which it is intended to meet their individual needs. In part, ownership is communicated by location of the microcomputers or terminals. If it is clear that there will be access conflicts, a hierarchy of use privileges or a scheduling procedure should be established. Staff should also be aware of interdependence on data accuracy and prompt updating among each part of the special education program.

Determining access to information. Access to student information is typically limited by associating with each user varying privilege levels with regard to "reading" (viewing data on a screen or print-out), "writing" (adding data to a file) and "deleting" or "purging" (removing). Typically these access privileges refer to reading-writing-deleting ALL information in a student file which is usually too general a protection scheme. Since the information in a student file varies in sensitivity or required confidentiality, the system should maintain confidentiality on a category basis, e.g., transportation services (low confidentiality), educational services (some confidentiality) psychological diagnostics (high confidentiality). A complete system will provide authorization or access priveleges on an item by item basis. The authorization system should maintain at least four levels and ideally eight or more privilege levels.

Depending on how staff access the system, there should be on-line reporting of which staff have accessed each student file; and, ideally, information should be available on who last entered information on each item, the date of the entry and the dates that various student reports have been printed. It should be possible to trace staff roles in generating the following kinds of reports: cumulative level of mastery, student IEP progress report, scheduling and grouping reports, students working on common objectives, quarterly reports to parents, child count, evaluations completed--along with administrative reports listing student names and associated information such as ID code, primary program, teacher, building, related services, withdrawal from school, current program status, parent permission, no parental response, evaluations pending (within dates), periodic reviews pending, re-evaluations pending, file reviews pending, current funding source and so on.

Assigning responsibility for software support and hardware maintenance. Both software and hardware may malfunction, and clear procedures should be established in advance for how to report and find solutions to any problems. If the original source programs are available to allow modification or correction of problems, a software maintenance person should be available. If the software maintenance person is not on site at all times, a dependable reporting procedure needs to be established so that all relevant details of problems are promptly described. Special education staff should first be directed to software and hardware documentation (in original or edited form) whenever any problems are encountered.

Setting-up a step-wise implementation to meet the needs of different staff groupings. If different groups within the special education program will be using the computer for different purposes and with different frequency, then the implementation plan should vary according to their individual needs. Where possible, the members of each group should cooperatively plan the pace of implementation and the level of support they would like to have during the initial stages of learning how to use the computer.

Evaluating the implementation. Evaluation of the computer-based management system--like any component of the program--is necessary to guarantee a constituency who are convinced of the value of the service. The system should be monitored in terms of annual fixed and variable costs and evaluated according to predetermined guidelines. This will give the special education director effective data upon which to argue for expansion or reduction of the computer support system. Staff comments regarding the ease of use of the system, the flexibility of information storage, the convenience of student information and immediate report-generation capability will all contribute to an analysis of enhanced productivity and, to some extent, of cost-effectiveness.

Establishing procedures for noting user comments/complaints to guide future enhancement plans. While the original designer of any software will typically maintain a list of desirable improvements to the software, the best source of such ideas is the staff who use the software on a routine basis. There should be a procedure for collecting user comments while the staff person is using the system; ideally this would be an on-line system, so at the moment of inspiration, the user can enter a comment into the computer for later access by those maintaining the software. Since on-line comment systems are not common, there should at the least be a pad of paper next to every microcomputer or terminal where comments (anonymous or not) may be recorded. Staff input should be encouraged as long as there is a system by which to provide prompt responses to suggestions and complaints; if there is no administrative or software support response, staff input will quickly be extinguished.

The Corvus Omninet links up to 64 microcomputers in a network providing high speed access to instructional and administrative programs on one or more interconnected hard disks.

Enhancing the System

Once a computer system becomes an integral part of your work style, you will become much more sophisticated than you ever suspected in your understanding of computers (computer-talk will no longer be threatening. You will speak it yourself!). You will also become much more intent on developing a truly powerful computer resource for yourself and your staff; a system much more capable and flexible than you (most likely) considered during the Initial Decisions and Implementation Stages. Your perspective on computers will change very rapidly over your first six months in using the system, particularly if you use it rather than delegating all tasks to your staff. Moreover, using an interactive computer system will stimulate your wish list for software capabilities in areas which you never considered before (i.e., you might start using a computer graphics package that will display a graphic pie chart or bar chart distributions of students in schools). The computer industry is extremely competitive, particularly in the microprocessor segment of the market, and there appears to be no end in sight to the innovations that will be introduced in the near future. The current generation of microcomputers are five to ten times as powerful as microcomputers of just two years ago--with added capabilities for networking, mass storage and voice processing. Given the fast pace of change with this technology, there is a preoccupation with software compatibility and extension of existing systems with add-on products. The major issues in the Enhancing the System Stage are discussed below.

Integrating your specialized software with standard off-the-shelf software. Whether you developed your own software or adopted off-the-shelf software in your initial implementation, you will eventually want to combine the capabilities of your current system with that of an existing software product or a new system which you would like to develop. Integration is typically a very difficult technical task but is frequently worth the effort to avoid developing an entirely new software system. For example, data-base management and financial analysis programs could be combined to allow the powerful features of both to be applied to the same data base.

Introducing networking or distributed processing. Over the past three years, "local area networks" have become a buzzword in the computer industry, and hardware/software developments have proceeded as rapidly for microcomputer networks as for larger computer networks. Some current networks allow up to 64 simultaneous users to have shared access to 80 million characters or more of storage and immediate delivery of electronic mail. The MEGAS electronic mail system provides automatic forwarding of mail between networked Corvus systems; MEGAS users pay no connect charge to their mail system and electronic messages are transferred between Corvus networks (e.g., between a network of users in Chicago and another network in Washington, D.C.) using low-cost night rates on high-speed data lines.

Incorporating past user comments into software modifications. Before user comments are interpreted and incorporated into software enhancements, staff members should be consulted regarding the projected improvements to the software. Often staff members will be better able to comment on improvements after experience with the system. Staff will often have helpful input if projected enhancements are clearly detailed and presented for feedback.

Interfacing the system to other computers for manual or automatic data transfer and analysis. Standards have not yet evolved to simplify the process of intercomputer communication. Software which is developed for this purpose should be developed in as general a way as possible so that it can be later modified to incorporate standards as they are established. Keep in mind that the less dependence on human operation of the data transfer, the more likely the system will operate in a predictable fashion.

Introducing new special applications software to meet the needs of staff members not currently getting computer support. As current staff members using the system expand their list of desired applications software, an effort should be made to expand the capabilities of the system to staff not currently served.

Changing the overall responsibilities for various computer operations. In the initial months or years, it will be necessary to maintain consulting support or in-house computer staff to install the system and to train staff to use it. At some point, it will be possible for a special education staff member to begin to adopt some of the technical responsibilities or maintain a liaison with technical persons no longer required on a frequent basis.

Improving your computer capability. Computers are increasingly powerful and at the same time increasingly affordable. Both of these trends are enabling computer applications for executives and administrators who have traditionally shunned direct computer use as well as office workers who heretofore did not have access to computers, despite the repetitiveness of many of their tasks. Part of using computers is staying alert to ways in which you can adopt improved software or hardware technology.

Looking into the Future

The major issues in the Looking into the Future Stage will have to do with:

1) The human-computer interface (implementation of principles such as those in Moran's Command Language Grammar) (Moran, 1981)
2) Accessibility of information (nationwide public databases)
3) Networking of computer resources (teletext data distribution)
4) Low-cost computer communications (fiber optics, Ethernet, satellite transmission, low power television)
5) Portability of software (UCSD-Pascal and Smalltalk)
6) Computer graphics (high resolution bit map graphics with three dimensional animation)
7) Interfacing computers to other communications technology (videodisc and audiodisc read/write storage technologies)
8) More effective management software (knowledge-based "expert" computer systems with artificial intelligence).

As you start to use computers for special education management, you must be flexible enough to adapt to the changes and improvements in the technology. As William Blake once stated, "What is now proved was once only imagin'd."

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EDUCATIONAL SOFTWARE: IN SEARCH OF QUALITY

Richard Howell, Paul Resta & Gary Adamson

The old adage which cautions not to "put the cart before the horse" has been found true time and again. Yet in our sometimes frantic efforts to bring microcomputers into the schools, many educators are doing just that. To use a more contemporary image, we might compare a microcomputer to a fancy car and the computer programs, or "software" to the fuel. Without high-quality fuel, you can't get good performance out of the car. Without high-quality software, computers may never reach their potential as a teaching tool. To think of purchasing the hardware (the computer itself) without checking to see that adequate educational software is available for it is to ignore some key prerequisites for that purchase.

This chapter is designed to introduce educators to the main types, advantages and shortcomings of the educational software now available. Although the field is still new, and many questions remain unanswered, the issues and concerns raised here should help those interested to make clear and realistic decisions about incorporating microcomputers into an educational program.

A Brief History of Computer Software

The history and development of software is related to the concept of a "template" or a set of instructions that result in the production of functionally identical materials. In 1780, a pioneer in the area, Joseph Jacquard, used the template to create a loom controlled by punched cardboard cards. All of the design features of the final fabric were incorporated into a sequence of holes punched in the series of cards. A mechanical "card reader" attached to the loom then translated the sequence of cards into a rug or tapestry that could be replicated as many times as was needed.

Later developments in the use of calculating machines by Charles Babbage in 1823 demonstrated that patterned sets of instructions could greatly reduce the amount of time needed to manipulate formulas and do accounting calculations. Then in 1880, Herman Hollerith decided to use punched cards and a simple card reader to compile data from the 1890 census in the United States. In the previous census, the final results had not been known for seven-and-a-half years. Hollerith's techniques reduced the turn-around time to only two-and-a-half years and convincingly demonstrated the efficacy of mechanized data storage and interpretation.

Developments in the United States from 1940-1960 in transistor and circuit design made the electronic computer a reality and increased the internal operating speed of these machines to just under the speed of light. Concomitant developments in program design led to more efficient and effective operating systems for the machines and the ability to store the programs internally so that machine operations became almost totally automatic. But the programs still had to be fed into the computer for processing, and punched cards were in use until the early 1970's. This mode of interaction, known as "batch processing," proved to be bulky and time-consuming--two things that the computer was supposed to circumvent. Disk storage,

especially the low-cost, polyvinyl "floppy diskette," made the punched card process obsolete and brought us the benefits of an easy, reliable storage format for programmed information, or software, as it has come to be called.

Contemporary software has advanced from highly abstract, symbolic programs--requiring a knowledge of both higher mathematics and computer sciences--to simple programs that a four-year-old child can use. Many modern, "user-friendly" programs require nothing other than reading skills in order to be used and understood.

Types of Educational Software

Software designed for educational applications generally fall into one of three categories: administrative; instructional; or testing and analysis. This paper concerns itself with the second use--with instructional or educational software. The authors have defined this as material for use on a computer that is specifically designed to instruct the user in a certain topic or content area. Thus the term encompasses professional training as well as classroom instructional materials. More recently, the term courseware has increasingly been used for software that is intended only for classroom use.

Instructional software or courseware, can be subdivided into three types: computer-assisted-instruction (CAI); interactive; and classroom management. CAI software has the longest history of the three, tracing its beginnings to the early 1960's. CAI programs are built on the assumption that students can learn directly from their interaction with the computer. It is based on a closed, diadic relationship between the student and the machine. Research has yet to show how this compares to the traditional interaction of student and teacher.

The second type, interactive software, allows for more flexible relationships. The teacher plays a role in the instruction, with materials designed to supplement the basic student/computer diad. The underlying concept is that the instructional triad is more efficient because it takes into account the human factors of attitudes and preferences as only a teacher can. The use of interactive software involves a shifting of the student's attention from hands-on computer activities to demonstrations and lectures by the teacher. Initial results of research at the University of New Mexico have shown that the interactive approach may be significantly more effective in performance (on a knowledge measure) than the CAI or traditional instructional approaches.

Classroom management software, the last of the three types, exists in a zone somewhere between administrative and instructional applications. It is generally intended for teachers to keep records on attendance, scheduling and grading. As a labor-saving device, more attention needs to be given such aids, since their impact might lead to a greater acceptance by teachers of the computer in their classroom.

For a partial listing of publishers of educational software, refer to the Appendix.

Advantages of Contemporary Educational Software

Some of the immediate advantages of classroom computers and educational software include individualized instruction, a flexible delivery system and multiple-use options. Microcomputers offer a degree of one-on-one interaction with a responsive instructional tool. If integrated properly, software can function as both a curriculum and a helpful adjunct to an ongoing program. As an adjunct, the software can be used to tutor remedial students, as a reinforcement to other types of learning strategies and also as an evaluative tool. Within

the curricular area, microcomputer software can be used to instruct students in math, language arts or other content areas. Perhaps one of the most provocative possibilities will be in teaching students how to program the microcomputer and create software for their own uses.

Microcomputer-based software has great potential for the efficient and effective delivery of information. The ability to change the content, display time and evaluative criteria makes software an extremely malleable instructional material. The flexibility that is possible with software is definitely greater than with traditional instructional materials. The capabilities of computers for evaluation and feedback also make them an attractive tool for instructional use.

The microcomputer-driven software can also be used over and over again. A standard piece of software on a floppy diskette can be used for 275 to 600 hours before data loss and deterioration make it unreliable. In an educational setting, this means that many students can have access to the information on the software with scheduling restrictions and the number of machines available as the only limitation. Taken together, these advantages make software a potentially valuable instructional material and worthy of a program of extensive research and development.

Shortcomings of Educational Software

While the instructional potential of microcomputers is great, there are important questions to consider before making the decision to purchase a system. One, of course, is cost. Some software costs are obvious, and some are hidden. Experience has shown that operating costs will double or triple the initial cost because of later peripheral software expansions. Software is quite expensive at present; the average cost of a blank diskette is approximately $4.00--fully programmed, that same disk costs approximately $32.00-$60.00. The care and maintenance of diskettes over time is an unexplored area that promises some costly surprises in the future.

Another serious concern regarding the instructional use of microcomputers is the present lack of research on its efficacy as an instructional tool. This must receive attention in order to justify the considerable expenditures for hardware and software. The priority areas for research are clearly:

- Effectiveness: Is microcomputer-based instruction more or less effective in delivering instruction than traditional forms?
- Instructional strategies: What are the best ways to integrate the microcomputer into the instructional environment?

There is a concern that much software may be inappropriate because of serious flaws in the instructional design, content or delivery mechanism. One reason for these flaws is the lack of input by educators or other content specialists. Software that is developed in a relatively isolated situation is often riddled with technical, interactional or instructional problems that make it inappropriate for use in education. These problems can only be solved by the inclusion of professional educators in the developmental process. Their input is needed in both developing the software and monitoring its effects.

An important issue that must be addressed before purchasing any computer system is hardware/software compatibility. The question of compatibility arises as every computer has a slightly different way of interpreting the instructions given to it--so most software is not transferrable across different makes of machines. The basic question is, "Will this program run on my particular type of machine?"

This points up one of the biggest reasons for the relatively slow pace of educational software development. The basic hardware/software incompatibility problem hinders the entire

population of microcomputer users from communicating directly with each other. The various hardware manufacturers have, for commercial reasons, chosen to develop almost identically functioning machinery that incorporate only minimal changes in their various compilers. (Compilers are computer programs used to translate other programs into machine language.) This requires software that is written (and thus read) in their specific type of computer languages (B.A.S.I.C., FORTRAN or PASCAL). These relatively minor differences make it costly and difficult for an APPLE-user to interact with, or exchange software with, for example, a TRS-80 user.

One possible solution to this problem is the creation of standard formats and conventions for the commonly used B.A.S.I.C., PASCAL and PILOT languages (and any others that differ significantly enough to be called a 'new' language). However, this can only be done by an aware, literate public that will demand the institution of generic languages from the equipment manufacturers.

Training Programs

Another current problem with instructional uses of microcomputers is the lack of training programs and trained personnel. In general, there are two ways in which people can learn how to use a computer. One is to have the machine deliver all the instruction via a self-instructional package that is designed for a specific content area. The second way involves a trained instructor--a more traditionally didactic approach with the student attending to either the computer or the teacher at any given time. Regardless of the training approach used, the need for training in the area of educational software is of paramount importance. Administrators, clerical staff and teachers, in particular, must be trained to respond to the new educational demands that come with the microcomputer. If the teacher is not knowledgeable and comfortable in the presence of a computer, then it will not receive in-house support as a classroom aid.

The lack of teacher participation in microcomputer training programs has been due, in part, to the lack of administrative support. For training programs to be effective, there will have to be an increase in financial support and incentives which would indicate a commitment by school administrators toward educational computing--as well as the development of materials and a college-level sequenced curriculum. The majority of training needs, at the present time, appear to be at the in-service level, since we must respond to the fact that there are few teachers in the field who are highly expert in educational applications of computers. Tables 1 and 2 list proposed content for in-service classes and levels of competence to be attained.

Evaluating Software Quality

The last and most important concern in considering software is that of quality: What constitutes high-quality courseware and how can different courseware programs be evaluated? Are there any criteria that would allow us to make an informed rating of the usefulness of any given software package?

Quality eludes a simple functional definition; we all know it exists, but we can't measure it reliably. In terms of educational software, however, there are a number of specific features to be considered. These include format, student-teacher interaction, technical features, content and adherence to sound educational principles (Olds, 1981; Wager, 1981).

Table 1

Proposed Content Areas For an In-Service Course on Microcomputers

Introduction to Microcomputing--Focuses on the history, overview and trends of the field. Basic microcomputer components, functions and operations would be stressed. The primary software applications in education (i.e., classroom management and instructional uses) would be discussed and experienced.

Introduction to B.A.S.I.C. or LOGO Language--Stresses the structure and functions of B.A.S.I.C. or LOGO language, with emphasis given to the development of problem-solving, trouble-shooting and structural programming skills. The goal is for the teacher to understand and be conversant with B.A.S.I.C. or LOGO language as a programming tool.

Evaluating Educational Software--Concentrates on developing evaluation skills that would permit teachers and administrators to judge the technical and interactional quality of a given piece of software.

Table 2

Levels of Competence in Working with Microcomputers

There are several different levels of possible interactions that can exist between users and microcomputers. At each level, a number of skills are involved that form a scope and sequence of educational microcomputing. The following breakdown of the levels and skills illustrates a possible hierarchy of educational microcomputing.

LEVEL	SKILLS/KNOWLEDGE ATTAINED
Literacy Level	Knowledge of software and uses, loading and basic operation skills, historical overview, knowledge of components and relation functions.
Software User Level	Knowledge and experience of a variety of commercially available software. Usually involves the building of software skills upon a previous knowledge base (i.e., business, education, accounting).
Programmer Level	There are many types and levels of programmers such that this category has several sub-categories (e.g., one-language-only programmers, multiple language programmers, or hardware/peripheral experts).

The "format" of a software program is the way in which information is delivered. It consists of the interaction between graphics, sound and text-display options. This interaction allows for a variety of possibilities to develop exciting and motivating instructional materials on the computer. Too often, however, software is limited to the "drill-and-practice" variety, or the content may consist solely of textual materials. This lack of sophistication often leaves the user with the feeling of having an expensive, electronic workbook or flash-cards with an automated page-turning capability.

The student-teacher interactional features of software consist of the "friendliness" of entry (ease of use) and the motivational aspects which make the software either exciting or boring to use. The accessibility of the software and its "friendliness" in part determine how much and how well it will be used. A good piece of software must not only be easy to use, but interesting and enjoyable. If not, the time spent working it may become aversive and counterproductive.

The technical features affecting software quality range from student and teacher interactional options to the way in which the program was conceived, written and produced. It includes such issues as structural integrity, reliability and utility as well as a lingering concern about whether the software will simply load and run successfully when it comes out of the package. If the design is poor or the internal program features are not adequate, then the software will not load and run correctly, if it loads at all! Key elements include adequacy of the programming (does it do what it says it does?), structural techniques and the use of appropriate documentation.

Content is perhaps the most important factor in terms of evaluating overall educational quality. The content must be technically correct and adhere to accepted educational principles and practices. The specific areas in which criteria must be developed are the following:

- The validity of various facts, models, rules and concepts that are being taught.
- Whether the materials are at the appropriate difficulty level for the intended audience (i.e., reading level).
- Relevance of the program to the subject matter.

The area of content quality is generally the concern of the curriculum specialist, and points to the need for such a person as part of the courseware development team. Of great concern is that the content be placed within a "scope and sequence" of skills development in an area--be it language arts, math or any other content area. Of particular importance, and yet only infrequently considered, is the fact that certain types of information are particularly amenable to training by computer and others are not.

The question of adherence to educational principles and philosophy includes such issues as reinforcement, age and grade appropriateness and documentation, as well as the integration between printed and programmed materials. Unfortunately, much educational software available today does not adhere to basic educational concepts.

Developing Evaluation Criteria

As noted by Blum (1982), the young software industry is at a developmental stage in which "programs of questionable value flood the market." At present, there is no widely accepted, systematic procedure for evaluating educational software programs. Although many of the elements of a program's technical quality can be readily assessed (e.g., use of graphics, color, animation, sound, etc.), the instructional quality of the program is more complex and

difficult to evaluate. Instructional software assessment is neither a standardized nor well-researched activity. Criteria, however, need to be established to help identify the instructional quality of software in addressing such questions as:

- What is the intended use of the program?
- Are there explicit objectives for the program?
- Is the presented activity appropriate for the concepts being taught?
- Is the presented activity clear and appropriate for the age of the student?
- Does the software take advantage of the computer's unique capabilities?
- Does the software provide positive feedback and differential responses to help students understand wrong answers (e.g., diagnostic and branching features)?
- Does the software provide for teacher modification or supplementation? What are the unintentional learning outcomes, both positive and negative?
- Is the software free of content errors?

Criteria need to be developed to help educators address these and other questions pertinent to the instructional quality of software. In the final analysis, the instructional quality of software will largely determine the acceptance of microcomputers in the schools.

A joint experimental project being conducted by the Albuquerque Public Schools and the University of New Mexico (APS/UNM)* is currently developing a software evaluation strategy that involves the development of criteria and the processes associated with applying, recording and storing of these evaluations for district- and college-wide uses. An experimental software evaluation form is presently being tested for inter-rater reliability and item-appropriateness; using teachers in evaluative roles as content specialists. The format of the evaluation addresses key software concerns: technical quality; student and teacher interactional features; and adherence to accepted educational principles and practices. Initial results have been favorable, and there are indications that this evaluation strategy can distinguish between quality levels of educational software.

This is only one of a number of efforts at the local, regional and national level to help strengthen the assessment of educational software. To significantly improve the quality of software in the future will require that we further refine and clarify criteria of instructionally sound software and we develop more effective mechanisms to share evaluative information.

Looking Ahead

The development of educational software has lagged behind general software development but promises to accelerate rapidly in the next few years. This article has attempted to identify the key issues of educational concern that must be answered in order for widescale acceptance of software application to occur. The most obvious need is for a group of informed administrators, teachers and parents to become involved in the developmental process. This group could provide needed input into the process, thereby assuring that the quality and utility of the software is kept high. The microcomputers and the software being developed today offer educators an exciting challenge: To understand and integrate a new technology into the educational process. However, the proponents of this technology have too often resorted to hyperbole and the "band-wagon effect" to generate interest--rather than research and demonstration projects.

*APS/UNM Software Evaluation Project. For more information, contact: Dr. Paul Resta, College of Education, University of New Mexico, 87131.

We cannot expect that widespread acceptance of micro-technologies will occur until cost, quality, training and hardware/software incompatibility issues are dealt with in a systematic manner and until an effective software evaluation strategy is formulated. Such a process would involve the development of a set of criteria that can be applied across all the software being marketed for education. This could greatly reduce the costs incurred by misinformed purchases.

In the future, software producers must respond in a more effective way to the great demand for programs that teach critical thinking skills and problem-solving strategies as well as higher-order skills such as application and synthesis of concepts. At the present time, such programs are sparse indeed.

The potential benefits of microcomputer software use in instruction outweigh the disadvantages. However, the microcomputer is practically useless to the educational process without software. No matter how advanced the machine architecture and chip design--it remains a piece of art without a soul if there isn't good software to run on it. This area clearly has educational implications of far-reaching impact. The future of the microcomputer in education is exciting; how fruitful and effective it will be is totally up to us.

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Howell, R.D. A Comparison of Auto-instructional vs. Traditional Instructional Approaches in Training B.A.S.I.C. Language. Incomplete doctoral dissertation, University of New Mexico.

Olds, H. Through a new looking glass. Microcomputing, September 1981, 62-74.

Wade, T.E. Evaluating computer instructional programs and other teacher units. Educational Technology Magazine, November 1980.

APPENDIX

Publishers of Educational Software

BLS Inc.
2503 Fairlee Rd.
Wilmington, DE 19810

George Earl
1302 South General McMullen
San Antonio, TX 78237

Educational Activities Inc.
P.O. Box 392
Freeport, NY 11520

Edu-Ware Services Inc.
P.O. Box 22222
Agoura, CA 91301

Grover Associates
c/o Scholastic Inc.
904 Sylvan Ave.
Englewood Cliffs, NJ 07632

Hartley Software
3268 Coach Lane #2A
Kentwood, MI 49508

Program Design Inc.
11 Idar Court
Greenwich, CT 06830

Mail Order Software Retailers

Gamco Industries Inc.
P.O. Box 310 P
Big Spring, TX 79720-0120
915/267-6327

The Micro Center
P.O. Box 6
Pleasantville, NY 10570
914/769-6002

Opportunities for Learning Inc.
8950 Lurline Ave.
Chatsworth, CA 91311
213/341-2535

Scholastic Software
Scholastic Inc.
904 Sylvan Ave.
Englewood Cliffs, NJ 07632
212/867-7700

COMMUNICATION/INFORMATION SYSTEMS FOR SPECIAL EDUCATION: THE SPECIALNET COMPUTER TELECOMMUNICATIONS NETWORK

Gary Snodgrass & Robert Campbell

Computer communication is changing the way we work, the way our offices are organized, in fact, the very way we interact with one another. The telephone has become so second nature that we assume one will be available within a few feet in any public place. And we accept telephone interruptions as part of the normal flow of the day. Did you ever stand in line at a store, waiting, while the clerk answered a detailed telephone request? Have you attended an important meeting, when at a critical moment, the key decision maker was pulled out of the meeting to take a telephone call? The telephone revolutionized our world. It changed the way in which people do business. At times it seems to rule our lives.

As important and commonplace as the telephone is now, it was not accepted instantly. People were very uncomfortable with the technology at first. They were not necessarily ready to embrace the telephone as the answer to their communication problems.

What was true of telephones in the past is true of computers today. Although they are gaining increasing acceptance, there are those who resist the use of new computer technology and who wish to maintain the "old" way of doing business.

In fact, computer-assisted communication is not new. Computers have long been part of the telephone system, working behind the scenes to help connect us to the people we want to reach. We have been using them in communication without being aware of it.

Now computers are opening a whole new communication field. They are being used to send written information between people from one office to another whether they are in the same building, across town, across the nation or the world. Computers have made instant written communication possible. This paper, for example, is being written in Washington, D.C. but will be delivered instantly via computer communication to Oregon for editing. At first this concept was highly technical and limited to engineers and computer experts. But, like the telephone, it is rapidly becoming a popular and easy-to-use means of communication. In fact, some systems are so simple that the average person can learn to use them effectively in a matter of minutes.

Communication/Information Systems and Special Education

Let's think for a minute about why computer communication will be important to us over the next few years. Within certain limits, computers can talk to one another. Data entered on one computer can be transferred to others. Nothing new about that; remote terminals have been used to enter and read information for many years. But a number of changes are occurring in the technology related to moving information (data). Among those changes is the ability to use regular telephone lines rather than lease special lines for this purpose. In addition, recent technological advances have made it possible for computers made by different manufacturers to communicate with each other via regular telephones. A terminal, microcomputer or word processing machine can be connected to a nearby telephone and used to send and receive written communication from another such device located almost anywhere in the world.

Yet to many people, computers remain complex and mysterious. This is due in some part to the jargon that has evolved around the new technology. Computer jargon seems as unnecessarily complex and as difficult to understand as that of the airlines. Did you ever wonder why airlines insist on calling planes "equipment" or cigarettes "smoking materials" or getting off the plane "deplaning?" Computer people do the same thing. For example, they call a system that is easy to use "user friendly." It is unfortunate, but true, that this barrier of jargon has gotten in the way of computer use.

Some of the benefits of computer-based information systems are already well known to educators. ERIC and DIALOG are familiar names to most of us. They allow us to search enormous data bases for information on specific topics which can then be obtained through use of a small computer or a terminal located many miles from the large computer that stores the information. In addition, a number of state and local education agencies share information through computer networks designed for special administrative application. Many readers are familiar with systems designed to collect data for state and federal reports. Such systems can share information that would otherwise require repeated handling. Some of these systems are very complex and expensive; others are less elaborate. They have one thing in common: They are closed systems which require special programming and specialized technical support. Systems of this complexity are generally well beyond the need and budgets of special education projects. However, there now are computerized communication/information services which require a minimum of training and equipment and which can provide valuable and cost-effective assistance to educational programs. Some key examples are described below.

Electronic Mail

Electronic Mail is a system of sending messages from one place to another via computer. The computer acts as the mail handler. Let's look at the SpecialNet electronic mail service as an example of how an electronic mail system works.

Each member of the SpecialNet network has a computer terminal, a microcomputer or a word processor with telephone communication capability. When a member of the network wishes to send a message to another member, he/she dials a telephone number to gain access to the Telenet network. (The Telenet network is one of two major national networks which connect local telephones to a variety of different computers. One of those computers is the one on which SpecialNet operates. It is located in Vienna, Virginia.) After a connection is made with the SpecialNet computer, a message can be sent or received from other members of the network. The process is outlined below:

The computer asks you for a command.

You will see:	COMMAND?
You type:	Compose
You will see:	TO:
You type:	(The names of any network members to whom you wish to send a message, e.g., WESTAR)
You will see:	CC:
You type:	(The names of any network members to whom you wish to send copies of your message)
You will see:	Subject:
You type:	(The subject of your message)
You will see:	TEXT:

You type:	(The text of your message)
You will see:	SEND?
You type:	Yes

It is that simple. The message is sent to the SpecialNet members' "electronic mailbox." The recipient of the message can "pick it up" whenever he/she wishes, by connecting a terminal, computer or word processor to the SpecialNet computer in Virginia. The message is "delivered" almost instantly; the sender can ask for a return receipt and the computer will inform him/her of the exact minute that the message was read.

Basic electronic mail systems do not require training. For the most part, they are so easy to use that self-instruction, using system documentation (user's manuals) is all that is necessary. However, each electronic mail system is different from the others, and some require more knowledge of conventional computer procedures than others. All systems presently available require some training for advanced applications, unless the user has substantial experience with computers in general and communication systems in particular.

Electronic Bulletin Boards

One benefit of electronic mail is the ability to develop "electronic bulletin boards." To put it simply, these are places where electronic mail is displayed. If you think of a conventional bulletin board in your office, you will get the idea. Bulletin boards display semi-public or public information. You can read everything on a bulletin board, pick and choose which messages to read, or ignore the bulletin board altogether. The same thing is true of electronic bulletin boards. A bulletin board can be organized into a subject areas (e.g., employment opportunities) or it can contain miscellaneous, unrelated messages. Of course, you can have as many special purpose bulletin boards in your office as the wall will hold. Similarly, you can have as many electronic bulletin boards as the host computer will hold.

The SpecialNet system includes a large number of special purpose bulletin boards which contain messages of particular importance to special education administrators. For example, one of the bulletin boards is named FEDERAL. It contains messages from the National Association of State Directors of Special Education (NASDSE) about the activities of Congress and the President as they relate to the administration of special education programs. The President's special education budget and the various congressional committee markups of the budget are examples of messages attached to the FEDERAL bulletin board.

Another special purpose bulletin board is called EMPLOYMENT. It contains job announcements from all over the United States. Announcements of vacancies are posted on this bulletin board by members of the SpecialNet network. Members of the Network have access to these as well as many other bulletin boards on topics of interest to special educators.

Retrieval of information from an electronic bulletin board is an easy process. For example, to retrieve information from the SpecialNet FEDERAL board one would simply respond to the program's COMMAND prompt as follows:

You will see:	COMMAND?
You type:	Check Federal
You will see:	NOW USING BULLETIN BOARD
You type:	Scan
You will see:	BULLETIN BOARD CONTAINS

A list of all the messages contained on the FEDERAL bulletin board (which have not previously been viewed) will be provided. You will see:

No.	Delivered	From	Subject	Lines
1	aug 3 16:28	nasdse	senate may hold regs hearing	11
2	aug 4 10:43	nasdse	highlight of reg changes	144
3	aug 5 16:42	nasdse	reg analysis available	17
4	aug 6 7:44	nasdse	senate hearing confirmation	3
5	aug 6 7:44	nasdse	regulations update	19
6	aug 6 17:23	nasdse	erdahl concerned with regs	67

From the subject heading, users would be able to determine whether that information is appropriate for their needs. For example, if item number 4 would be useful, the following response would be made:

You will see: COMMAND?
You type: Read 4
You will see:

Posted: Fri Aug 6, 1982 7:40 am edt
From: Nasdse
To: Federal
Subj: Senate hearing confirmation

It has been confirmed that a senate hearing will be held on Tuesday, August 19th at 10:00 am. In room 4232 - Dirksen Building. Secretary Bell will testify on the proposed regulatory changes for PL 94-142.

In addition to the bulletin boards with a specific focus on administrative issues there are several with a primary focus on instructional and program resources. The MULTIHANDICAPPED and EARLYCHILDHOOD electronic bulletin boards are examples. These boards are accessed in a similar fashion as described for the FEDERAL bulletin board. In order to check the EARLYCHILDHOOD board:

You will see: COMMAND?
You type: Check Earlychildhood
You will see: NOW USING BULLETIN BOARD
You type: Scan since 8/1
You will see:

No.	Delivered	From	Subject	Lines
1	aug 4 13:22	westar	publication: Mental Disabilities	21
2	aug 5 12:20	westar	filmstrip for K-3 children	13

To read item number 2 you would type Read 2 after the COMMAND PROMPT:

COMMAND? Read 2

Posted: Thu Aug 5, 1982 11:26 am edt
From: Nasdse
To: Earlychildhood
Subj: Filmstrip for K-3 children

A new filmstrip, "Different from You...and Like You, Too", designed for children K-3, shows model behavior through films that demonstrate positive interaction of the non-handicapped with handicapped children. The filmstrip was produced by Jane Schulz of Western Carolina University under a grant from the Office of Special Education, the Department of Education.

Features: 5 minutes, color
82 pictures in 35 mm filmstrip
Audiocassette, 100 HZ + audible signals

Available for $25.00 from: Lawren Productions, Inc., P.O. BOX 666, Mendocino, CA 954600. Telephone: 707/937-0536

More than a dozen such bulletin boards are currently available on SpecialNet, with many more boards of regional and local interest planned. Some states have developed bulletin boards that contain meesages of interest to special educators in those states. It is possible for a state to develop as many special purpose bulletin boards as desired. Special projects and service centers can also develop bulletin boards for dissemination of project information.

Other Benefits

With telecommunications systems, data can be instantly transferred from one point to another. Child-count information, budget requirements, statistical information--in fact, almost anything that can be typed--can be transmitted easily and instantly across town or across the country.

Questionnaires can be developed, so that all responses are received with a uniform format. Centers that process orders for materials can create electronic order forms which will expedite the ordering process and reduce the number of errors involved in the process, while at the same time reducing the staff time required to answer the telephones.

Electronic mail not only reduces mail time to seconds rather than days, but it eliminates what has been aptly called "telephone tag." Telephone tag has been described by Foulger (1981) as the situation in which one executive makes repeated attempts to reach another by phone, and the other makes unsuccessful attempts to return the calls. Sometimes this goes on for days. Electronic mail eliminates telephone tag, because the computer stores the message until the recipient is ready to read it on a display or printer terminal. In a study conducted by International Resource Development, Inc., Foulger points out that the total time and money wasted in telephone tag varies; the busier the two parties involved in the phone call are--in meetings, travel or other phone calls--the more likely the "tag" is to be extended and repeated. The average cost of telephone tag at the vice presidential level in a medium-to-large company is estimated by Foulger to be more than $10 per successful phone call with the total cost to U.S. industry as a whole as much as $12 billion per year.

Overcoming Barriers to Implementation

As did the telephone, computer-based electronic mail faces a number of barriers to full implementation. Another finding of the Foulger study was that about one-quarter of U.S. executives--particularly in the older age groups--refuse to work with terminals. The reason for this refusal is clear; executives feel it is demeaning to have to type on a keyboard of any sort. There is a school of thought which believes that executives lose status if they touch office machines--after all, that's their secretary's job. A similar problem can be found in the education community.

Another problem among education agencies is the often absolute control that data processing or computer departments have over the purchase and application of computers and terminals. As with so many other worthy enterprises in education, electronic mail is plagued by turf protection. Fortunately, this problem is beginning to be reduced by a revolution in microcomputer applications in educational settings. Microcomputers can be used to access electronic mail systems in addition to a host of other educational applications now available.

SpecialNet has grown to more than 400 subscribers in 36 states in less than six months. It is anticipated that the system will include as many as 10,000 subscribers in school districts, regional and state offices across the nation within three years. The rapid growth of the SpecialNet network is attributable to several factors, including: educators' need for rapid access to information, the growing availability of microcomputers in educational settings, and the significant cost savings available through this method of communication.

Computer Communication: Where Is It Going From Here? How Can I Use It?

The first questions that most people ask are, "Where is this technology going? If I buy it now, will it be out of date in a year or so?" It is true that things are changing so fast that even the specialists have difficulty keeping up? Although computer prices have come down dramatically over the past few years, prices are not expected to get much lower. True, there are continuing improvements in quality and in the features you get. But with personnel costs constantly increasing, it may not any longer be wise to wait before jumping into the technological revolution. Electronic mail may be the least costly first step into computer application. It most certainly will not be the last.

An explosive increase is expected in the number of users of computer-based electronic mail systems. Currently about 160,000 people make use of these systems. By 1985 the number of users is expected to reach one million, and by 1991 almost half of all white-collar workers--21 million--may be using the systems. By then, they will have been integrated with store-and-forward voice message systems, and will be hooked into huge optical-disc-based data banks (Foulger, 1981).

The question of "How can I use it?" can only be answered by each individual educator. There are a number of excellent reasons to consider using this communications technology. Campbell, Snodgrass and Gibbs (1982) present a rationale which may be useful in evaluating your needs. This rationale is based on several assumptions which include:

1. Persons and groups of persons having a particular need to communicate with each other or to receive information provided by an individual, group or some other resource. Educators generally represent an informal network of professionals with particular needs to communicate concerning their research and development, practices and resources.

2. Much of the information to be shared can be expressed in a written format. In general much of the information shared in special education is communicated through journals, textbooks and newsletters as well as personal communication.
3. There is a need to conserve resources, both fiscal and human, while getting the most benefit. Special education is faced with declining fiscal resources and increased needs to share more information and both human and material resources.
4. Access to a computer terminal is possible. Microprocessors are playing a growing role in the delivery of special education instruction. A microprocessor represents the major capital outlay when considering participation in a computer-assisted information network.
5. A willingness to explore new technology must be evident. Of all the disciplines within education, special education has demonstrated a willingness to experiment with new technology.

If each of these assumptions were restated as questions you could evaluate your need to participate in a special education communications network. Positive responses to a majority of the questions would indicate the possible importance of SpecialNet to your agency or setting.

Nearly anyone can, regardless of previous experience with computers, operate a telecommunications system. In addition, a number of adaptive devices are available for handicapped access. Braille and large type printers are available for the visually impaired. Because computer communication makes use of a visual medium the hearing impaired require no special modifications. Finally, a variety of adaptive devices are presently available and being developed for the physically handicapped. These and other adaptations are possible insuring that nearly anyone can apply this technology.

Other Electronic Mail Systems

The Source
1616 Anderson Road, McLean, VA 22102
Telephone: 703/821-6660

The best known and largest of the systems currently available is the Source. (Many SpecialNet subscribers subscribe to the Source also.) It provides a wide variety of personal and business data processing services, including access to more than 2000 data bases and applications packages. Daily stock market reports are available on-line, as are UP Wire Service news reports, educational programs, a consumer buying service and an airline/restaurant/theater reservation service.

CompuServe
5000 Arlington Center Boulevard, Columbus, OH 43220
Telephone: 614/457-8600

This service offers news and family information, including international, national, regional and local news, weather, sports commentary--all up-to-the minute and indexed by key words for easy selection of topics. The information is available from international news services and from prominent news publications. Family service information is available on subjects such as food, recipes, meal preparation, costs per serving, nutrition, personal health, gardening, home

decorating, building, crafts, travel and money management. A bank of general reference information on world events, history, geography and famous people is available as well. CompuServe also provides access to electronic mail, a national bulletin board, MicroQuote Securities Information, MicroNet Personal Computing and a computer software exchange.

Bowne Information Systems
160 Water Street, New York, NY 10038
Telephone: 212/952-4400

Major application areas of Bowne Information Systems include text processing, records management, photocomposition, laser printing and electronic mail. Specialties include litigation support and word processing services.

Computer Corporation of America
575 Technology Square Cambridge, MA 02139
Telephone: 617/491-3670

COMET, a terminal-oriented electronic mail system, offers: creation of messages, including editing (word processing) facilities; message distribution, including management of distribution lists; computerized filing and retrieval; and auxilliary services, such as message forwarding and access protection. The COMET system is minicomputer-based and is also suitable for in-house installation.

Selecting a System

If you own a microcomputer or terminal, the selection of a communication/information system is relatively easy. First you should examine your communication/information needs. You should ask yourself the following questions:

1. With whom must I communicate?
2. With whom would I like to be able to communicate?
3. Are these individuals/agencies using the system in question?
4. How much will the system cost?
   a. Hourly rate during the time you expect to be using the system?
   b. Any hidden charges, special charges, minimum charge?
   c. What is the average annual cost for users?
5. What kind of information do I need?
6. Is this information available through a less expensive media?
7. Is it important to have information available more rapidly?

Further considerations include: Do I need general news stories (health, social, TV, world events, national events, sports)? Do I want access to computer games on this system? Do I need a system that can be used for accounting?

When you examine any of the systems listed here, others that are currently available or soon will be available, it is important that you carefully determine the services the system offers in relation to its cost to you. (Some systems cost a great deal more than is immediately apparent.) Large systems such as the Source, and CompuServe focus on broad-based services

(e.g., UPI Wire Service), business services (e.g., stock market reports), entertainment (e.g., restaurant menus), and family-oriented information (e.g., consumer purchasing services, computer games). Special purpose systems such as SpecialNet will target the needs of special interest groups (e.g.,special educators, vocational rehabilitation administrators, state and local education agencies). Many systems have special features available only to members. Many individuals find that a combination of several services best meets their needs.

It is important to understand that it is not possible to subscribe to one system and send or receive messages or information from another system. For example, a SpecialNet subscriber cannot send or receive messages to/from a Source subscriber, unless the Source subscriber is also a SpecialNet subscriber or vice versa.

Selecting Equipment

Equipment selection depends on how much you would like to spend, what you already own and what other services in addition to communication/information you would like to have. Each choice has its positive and negative side. Some of the options and their approximate cost are listed and discussed below:

A microcomputer with communication capability offers the benefit of a number of potential functions in addition to its ability to connect to a network. Among the added functions are word processing, computer-assisted instruction (CAI) and a variety of office applications. The memory capacity of a microcomputer allows for more efficient, less costly connection to a network as well. Microcomputers equipped with communication capability range in cost from $2,000 to $10,000. Many microcomputers are advertised at lower costs, but when you add the features you will want, the least expensive system will cost about $2,000. Computers do require additional training and experience. It is not quite as easy to use a computer to connect to a communication/information network as it is to use a "dumb terminal".

A computer terminal (dumb terminal) is the easiest way to connect to a network. It requires little or no training. Terminals can be portable, so that users can carry them, like a brief case, to meetings in or out-of-town. They can connect with the communication/information network from almost any telephone. Prices range from about $1,000 to $2,500, depending upon added features, such as the ability to produce printed copies of messages. Dumb terminals are so-called because they are not able to do anything unless they are connected to a computer. They are designed to work with computers from remote locations. The authors use a portable terminal whenever they travel. It allows them to pick-up "mail" and to send messages when they are out-of-town.

Smart terminals, or memory terminals, offer the additional advantage of internal memory. The addition of memory to a terminal adds significantly to its cost. Smart terminals range in cost from $2,000 to $10,000. They work very well with communication/information systems. Use of their memory capacity can significantly reduce the cost of connect time when using the communication capability of a network.

Most word processors are very well suited for use with information/communication networks. As with microcomputers and "smart" terminals, their memory capacity allows

you to type messages off-line, before you connect to the network. After a message is typed exactly as you want it, you connect the word processor to the network and send the message very rapidly, thereby saving the cost of connect time while typing and editing. A word processor is particularly helpful if you plan to send long messages, charts or tables. Word processors are more expensive than the other types of equipment listed, and should therefore be considered only if you plan to use them primarily as word processors. Again, like microcomputers, word processors require extra training for use beyond that required to use a communication/information network. If you already own a word processor, communication capability can generally be added for $2,000-$4,000. Word processors range in price from $7,500 to $25,000.

As you can see from the very brief list above, equipment decisions can be more difficult than deciding which network to join. A good rule of thumb, however, is to keep the equipment as simple as possible if you have not had previous experience with computers or word processors. Portable equipment takes maximum advantage of the instant communication ability of networks. It is for that reason, and its extremely simple operation, that the authors often recommend it to first-time users.

Summary

There is public resistance to every major technological change. But despite a variety of obstacles and misconceptions, it is time to acknowlege that computerized communication/information systems are not longer a thing of the future. They are cost-effective, easy-to-use, rapidly growing in popularity and within the budget and capabilities of a wide variety of offices, businesses and educational programs. Once you have familiarized yourself with the range of systems and equipment available, there is no time like right now to take advantage of this new technology.

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CABLE TELEVISION: A MEDIUM FOR EXTENDING AND IMPROVING EDUCATION

Judy Smith, Jim Leach & Charles (Skip) MacArthur

Television has been with us for more than a generation and has changed our society in many respects. The cable television medium diverges from the traditional concept of commercial television in several ways that have vast potentials and applications for information storage and retrieval, for communications networking, for accomplishment of day-to-day transactions--and for changing, extending and improving classroom education and professional development. The purpose of this chapter is to give special educators a first glance at the powerful opportunities that cable television offers.

Technology and the Industry

Satellites make present-day cable TV communication possible. A communications satellite can have several transponders, each with a receiver and a transmitter. Because it is far out in space, a single satellite can transmit to a broad geographic area (called its "footprint"). Quite a number of satellites are up there (so many, in fact, that outer space is getting crowded with them), and they are individually owned by such corporations as Radio Corporation of America (RCA), International Business Machines (IBM), Western Union, American Telephone and Telegraph (ATT/GTE), and The Hughes Communications Company. These companies sell satellite access to cable communications companies and networks. The purchase arrangements hook up a cable company with a satellite so that the company can make direct contact through knowledge of the satellite's coordinates in space. The company then transmits its programming to its transponder on the satellite, and the satellite beams back the programming over a defined broad geographical area.

When cable television got started in the 1960's, its only purpose was to bring TV reception to areas that were remote from the broadcast areas of major cities; this was done by erecting community antennas. Thus, cable TV was simply a conduit that transferred the programming of network affiliates of ABC, NBC, CBS and public television to communities at some distance from the affiliate stations.

Three events in the 1970's led to the rapid expansion of cable TV. First, the Federal Communications Commission removed many of its restrictive regulations on cable development. Second, satellite communications expanded and became economically feasible. Third, the highly successful entry of Home Box Office (HBO) into the marketplace in 1976 demonstrated that people would pay to watch shows not offered by the major networks. Since then, cable has grown rapidly. In 1970, 5.3 million households subscribed to cable TV; by 1981 that figure had increased to 20 million or 25% of households with TV in the country (Neilsen, 1982). In many communities, the penetration of cable into homes with TV is far greater than the national percentage. Areas with the highest percentages of cable subscribers among TV households are as follows (Arbitron, 1981; Nielsen, 1981). Notice the number that are rural.

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Palm Springs, California	85.6%
Victoria, Texas	83.7%
Santa Barbara-Santa Maria-San Luis Obispo, California	78.4%
San Angelo, Texas	76.5%
Anniston, Alabama	75.7%
Laredo, Texas	75.1%
Marquette, Michigan	73.4%
Parkersburg, West Virginia	73.0%
Sarasota, Florida	69.9%
Casper-Riverton, Wyoming	69.3%
Johnstown-Altoona, Pennsylvania	68.2%
Biloxi-Gulfport-Pascagoula, Mississippi	67.5%
Beckley-Bluefield-Oak Hill, West Virginia	67.2%
Monterey-Salinas, California	67.1%
Yuma, Arizona-El Centro, California	66.8%
Elmira, New York	66.4%
Lima, Ohio	65.4%

Today, cable TV is a field of several hundred highly competitive companies that provide not only access to the commercial networks, but also multiple channels of specialized programming and locally produced programming. These companies are essentially of three types: the cable service company (or the classic conduit originated in the 1960's but with far more programming to transmit to consumers); the cable programming company (which produces or provides specialized programming to service companies); and companies which provide both cable service and cable programming.

A cable service company that does not produce its own programming will purchase movies, special productions, sports, Broadway shows, rock concerts, soft and hard R-rated films, news, and many other sorts of content--as channels--from a company that produces programming. Among these producers are HBO (Home Box Office), Showtime, ESPN (The Entertainment Sports Program Network), The Cable Health Network, CNN (The Cable TV News Network), C-SPAN (the Cable Satellite Network), Public Affairs, several networks that provide programming in Spanish (SIN-TV and SUN-TV), and such information networks as the Associated Press News Service. These purchased-program channels reach specific segments of the population. For example, if you like sports, you can watch sports events 24 hours a day on your cable sports channel--not only live sports events, but also videotaped events that are repeated at various times. (It is possible that sports and similar channels will eventually proliferate into several channels that are even more specific, e.g., a baseball channel, a football channel, a basketball channel, and so forth.)

This may sound like rather exclusive content unless you also realize that a cable service company can mount 50 channels or more, each carrying its own specialty. It is the sum total of the special-interest channels that is intended to serve the tastes and interests of that cable company's broadcast community, which in fact influences the selection of those channels. Commercial network television, on the other hand, attempts to reach an entire national audience through one channel: the audience watches what the commercial network presents, when it presents it.

Companies like Warner-Amex (Warner Communications/American Express), Storer Cable Communications, Cox Cable Communication, and American TV and Communications Corporation (the cable company of TIME, Inc.), to name a few, not only operate a cable service with purchased programming, but also produce some of their own programming, both nationally and locally at their affiliate stations. For example, Warner-Amex produces Satellite Entertainment (a movie channel), Nicolodeon (a channel for children and youth), and MTV (Music TV, 24 hours of rock and roll) and The Movie Channel (movies 24 hours a day). Moreover, virtually all cable companies offer several channels that the public and the professions may program at the local level.

Cable Comes To Town

Cable companies compete heavily for franchises in major cities. The city government decides which cable company will wire a city and bring in its services. Competing companies must demonstrate that they can build a system within a specified time frame, that they will provide certain municipal services, that they will answer the city's needs for local programming, and that they will provide the proper studios and production equipment to originate local programming. Further, city governments are most interested in cable as a revenue producer, inasmuch as the city receives 2 to 3 percent of cable subscription revenue in return for cable's use of the public right-of-way. City officials are becoming more and more sophisticated in the franchise process and are moving into the driver's seat in these negotiations. Therefore, educators have every opportunity to make clear their own needs and plans for cable service in order that these possibilities may be introduced into franchise negotiations.

Once a franchise has been contracted, the cable company may spend several million dollars in start-up costs to bring cable television into a community. This enormous short-term investment has a long-term payoff, which rests primarily in continually increasing the number of subscribers to the company's cable channels. Subscription arrangements vary from company to company, but generally the individual subscriber pays a flat monthly rate for basic service (which might include, for example, 27 specialized channels; a news network channel; 24-hour weather radar; a channel in Spanish; networking programming from NBC, ABC, CBS and public TV; and channels for local program origination). Beyond the basic subscription package, the subscriber may elect to pay additional fees for access to such channels as Home Box Office, Showtime, Sports, or QUBE (the interactive channel pioneered by Warner Amex), and there are some cable companies that provide news as an additional pay tier. The typical one-time installation fee is $16.00, while the average monthly basic fee is $8.10 (Kagan, 1981).

Other long-term payoffs may prove to be as significant as subscription revenues. As the size of the cable market increases, the attractiveness of this market to advertisers will be enhanced, and more programs will include commercials. In addition, cable hookups make possible a wide range of future services other than entertainment. Some cable companies are already offering burglar and fire protection services monitored by cable. Interactive systems make it possible to offer banking and shopping services as well as a variety of information and individualized learning programs. Cable companies stand to earn additional revenues through offering such services.

Now, let's go back to the basic service package, which includes channels whose programming is local in origination, for it is here that cable TV becomes of immense importance to educators. Most cable franchises include arrangements for a municipal channel,

a local origination channel intended for local entertainment, one or more public access channels, and one or more educational channels.

The municipal channel is for communication by the city government. The local entertainment channel includes programming such as symphony performances, civic events, programs at the local zoo, and the like. Public access channels are unstructured and open for any public use, and in some communities there may be a Black access channel, a Spanish access channel, a religious access channel, and others.

Another local origination channel is intended for educational purposes, which can include classroom instructon, college and university instruction, in-service and professional development, and other applications. It would not be impossible for a community to develop separate channels for each of these educational endeavors--if educators can learn to plan and program for them, and if educators and learners will also be an audience for them.

New Dimensions and Horizons

Just around the corner lies the capacity for some cable subscribers to respond or "talk back" to their television through a hand-held console that is part of the Warner Amex QUBE two-way cable television system. QUBE combines the advantages of the computer with the broad distribution capabilities of cable. The interactive feature is the keystone for several tremendous communications advancements. For example, QUBE subscribers can take college courses for credit and respond to their instructors during the instructional program; they can order merchandise, express their opinions, vote on issues, select library books, find answers to complaints, "talk back" to talk show hosts, participate in debates, and directly influence the content of programming. The two-way QUBE system was piloted in Columbus, Ohio, and is now multiplying in systems being initiated soon in Pittsburgh, Cincinnati, Houston, Dallas and the suburbs of St. Louis. Its impact will without doubt reshape the entire nature of the television industry.

Also coming are various applications of teletext and videotex. These information services (for example, those operated by Dow Jones, On-Net Information Services, and the Associated Press and United Press wire services), which currently operate through a computer terminal, telephone access and a keyboard in the home or office, may eventually bring their data banks to your television screen. Two-way videotex systems, in addition to information retrieval, can provide home-based shopping and banking services, computer games, burglar and fire alarm protection, and home energy management. Analysts expect videotex to reach 2 to 5 percent of households by 1985 and 30 to 40 percent by the year 2000 (Tydeman, 1982).

The American Telephone and Telegraph Company is initiating a new television conferencing service in Washington, D.C., and New York City which should be operating in 16 other cities within the year, and in 42 cities by the end of 1983. The service, called "Picture Phone Meeting Service," is costly but places committee members at opposite ends of the contry face to face via the television screen to conduct their business. Thomas A. Shannon, Executive Director of the National School Boards Association, recently said that "clearly teleconferencing by long line or satellite will be important to school boards associations in the future," and he predicted that costs will "decline as expertise improves and competition increases, just as has occurred in the past decade with computer technology." He added that the National School Boards Association is "actively reviewing teleconferencing by satellite for meetings and programs in the future" (Teleconferencing: Coming But Expensive, 1982, p. 4).

Richard Byrne, Associate Dean of the University of Southern California's Annenberg School of Communications, sees the communications revolution as "the great equalizer" for many disabled people. For example, new developments in telecommunications will permit deaf people to communicate more easily, and, "when electronic mail is widespread, and we've come to depend on it, the disparity between deaf people and the rest of us will be substantially reduced," says Charles Jackson, a partner in the Washington communications consulting firm of Shooshan and Jackson (Pollan, 1982, p. 29).

> Not only the deaf, but all of America's 40 million seriously disabled people have much to gain from the new communications technology. Electronic banking, for instance, is much more than a newfangled convenience for a busy executive. It spells the difference between banking at home in front of a television set and not banking at all. When banking, shopping, sending electronic letters, and visiting "libraries" by way of two-way cable are prevalent, economic and social links can be restored to the disabled. (Pollan, 1982, p. 29)

This new world is absolutely breathtaking. The future is here. All of us are strangers on this new landscape. Some will lead; others will follow; some will resist--and a few will be true adventurers. This is our opportunity of a lifetime. We can pioneer in the technology that will revolutionize our profession, our work, and the education of exceptional children. The rest of this chapter will tell you how simple it can be to become the future.

Cable vs. Commercial Television--and the Benefits to Education

No one pretends that the bottom line for both cable television and commercial network television is anything but profit. This is business; it is the communications and entertainment industry. However, the commercial and cable branches of the telecommunications industry pursue their profits in somewhat different ways, and these differences are manifested mainly in their accountability and service to the public, their programming structures, and their revenue sources.

Accountability

Both cable and commercial network television stations are franchised or licensed to serve the public interest. The difference is that cable service is most accountable at the local level, while commercial service is most accountable at the national level. Though community pressure can be brought to bear in either case, the pressure is more direct in the case of cable television.

Commercial television networks and stations are governed by the Federal Communications Commission (FCC), a part of the federal government. The FCC requires certain procedures be followed when stations file an application or renewal of a license. These procedures require that stations elicit local comment, and consequently local citizen coalitions could take these opportunities to become militant and protest to the FCC. In 1981, however, federal requirements related to public accountability and stations' license renewals have been dramatically changed in favor of the station. In fact "we have lost a large part of an admirable communications law that fostered vital interaction between the radio and television licensees and the people of their communities. With the longer license terms, our ability to participate in the broadcast system as citizens has been lessened by about half" (Brown, 1981, p. 18).

Each cable station, on the other hand, is governed by the specifications of its franchise from the city government. This franchise is a legal contract binding to both parties, and it specifies, among other things, the services to the public that are to be provided by the cable station. Franchise agreements can be drawn up for period as long as 15 years, but within any franchise period there are legally documented checkpoints for public review and for periodic reports to the city government. Both parties of the franchise can request changes in the services and conditions originally specified; either party can comply or refuse; and either party can take the matter to court.

Moreover, during the competition for the franchise, cable companies routinely survey community interests and conduct market research to determine the nature of services and programming that will be best received. After all, cable TV is a commercial venture and the payoff will come from numbers of subscribers.

Cable franchise opportunities depend on meeting the needs of the community. Franchise negotiations are matters of public record and concern. Educators, like all groups, are part of the community and entitled to a say in programming decisions. The rest is obvious: educators should take the opportunity to influence the competing cable companies and the city government in behalf of the services, channels, programming and participation that will enhance the community's educational programs. And, of course, you can talk more easily and more directly with your city council and a competing cable representative than with the Federal Communications Commission in Washington.

Programming

Commercial network television operates in a highly structured manner, presenting specific programs in specific time slots. Like cable, commercial networks also purchase programming extensively, from such production companies as MTM (Mary Tyler Moore Productions) and Tandem Productions. Everything is matched to time slots in prime time or fringe time or down time. Time slots and programming, in turn, respond to advertising potentials.

As a result, commercial networks offer relatively little time for locally produced programming. In most communities, the local evening news is the only hot ticket in local production. Further, though the Federal Communications Commission requires commercial stations to devote a certain percentage of air time to public service, this time is represented almost exclusively in public service spot announcements, not in programming. The few public interest programs are offered at odd times, such as very early morning.

Although cable does carry NBC, ABC, CBS and PBS, its more extensive offerings come through its array of other special-interest channels. Commercial television networks, with one channel each, aim to reach the broadest possible audience with each program and spend large amounts to produce each program. Cable TV, with many channels, can offer programming to smaller audiences with special interests. Special interests can mean local interests--parents of school children, handicapped persons, community college students, or any other definable audience.

This flexibility of cable TV becomes quite valuable to the public through cable's local origination and public access channels, as specified in the franchise. Cable can offer vastly more local programming than can commercial television because it has so much more channel time to give. The public access channel is open to all comers. The municipal access channel can keep citizens up to date on issues and decisions before its government. Local origination channels can broadcast matters of importance to local business and industry and can bring the symphony, the civic choir, the high school play and similar productions into viewers' homes on several occasions and at different times. The educational channels can serve every imaginable

purpose in instructional services and professional development. The only restrictions to the public access and local origination channels are guidelines that are far from prohibitive, and which are intended only to ensure appropriateness and to prevent one group from monopolizing all services.

Payoffs and Values

Commercial network television "is not primarily a communications medium. It is primarily a sales medium. In an interest reversal of the normal box office concept, it sells its audience to its actual and only customers, the advertisers. The presentation of programs is not what the business is all about, for the programs are merely the packages for the commercials which alone bring in the profits and pay everyone's salary" (Bronfeld, 1981, pp. 3-4).

Cable television is paid for by viewers, although, as subscriber numbers grow, cable also becomes an attractive advertising medium, and some companies are profiting from this revenue source. Regardless of the presence or absence of cable advertising, however, its real basis is the community and the subscribers, in whose service the franchise is let in the first place. Moreover, the public access and local origination channels are not subject to time constraints and advertiser interruptions.

All of this adds up to some stupendous values for those who are far-sighted enough to make low-cost use of this high-cost medium for educational purposes. Commercial network television program time is virtually always sold, and it is program time that you are buying. Translated into your dollars, here is what it means. If you were fortunate enough to find a local commercial television station interested enough to permit you to present a program, you would pay $4000 to $5000 just for the hour's worth of air time. Being an educator, you might get a cost break from the station on production costs, and your outlay for production time might be $150 to $200 per hour. Considering a 3:1 ratio of production time to air time, you would likely pay $600 more for production assistance. And what you would have purchased is a one-shot, one-hour presentation on television; surely not at prime time.

You might be interested, instead, in getting into the big time with a series on public television, which is a conduit for programs. The procedure is generally to work out a few programs on paper with the help of a person who knows television, submit proposals for funding from a source such as Ford or Exxon, obtain funding and produce a pilot program. The pilot will go to PBS Executive Headquarters in Washington for an audition. If the pilot is approved, programming is ordinarily planned in 13-week or 26-week segments, at a cost of $75,000 to $100,000 per show, if all work is done by the TV facility. These costs cover production, salaries, talent, technology, production, line charges and union rates. (Simonton, 1977). Through local cable television stations in many parts of the country, you can have all of this and more--free.

Educators Need Cable TV--and Cable Needs Educators

Cable television presents a number of advantages for educational purposes. Whereas traditional television is thought to have led to increased individual isolation, cable television represents a genuine community linkage that can bring people together and increase mutual understanding. The medium has a very high capacity to involve education in its processes in an extremely cost-effective and time-effective way. There is convenience in sending and receiving; education can occur wherever there is a television set.

Despite the enormous value and potential of cable's public access and local origination channels, even the most responsive cable stations are having trouble filling up those channels with substantial programming. On the one hand, many of the people who could bring the substance of education and other disciplines to this medium have not arrived at the cable possibility. On the other hand, lots of people have ideas but don't know how to express them in the video medium. Clearly, a meeting of minds and energies needs to occur. Many cable stations are reaching out, and educators need to accept the invitation.

Some Applications

Consider the power of cable television to expedite and actually improve classroom instruction, personnel preparation, in-service training and staff development. Consider its capacity to reach the public with a balanced view of what the schools, colleges and universities are really accomplishing.

In-service teacher education programmed at convenient and repeated times. Teachers often report that they would be more amenable to staff development sessions if the timing didn't interfere with family duties and activities. With cable as the conveyor, personnel can participate in workshops and instructions at midnight, if they so desire, and they can participate in the same session several times. Where the QUBE system is available, its "narrowcast" ability can send programming only into pre-selected sets. Narrowcast programs can be beamed to a specific group--educational professionals only, residents of one school district or members of any special organization.

Cable instruction with collaborative college credit arrangements. Early birds have for years taken televised courses for college credit. You can do the same with cable TV even if you aren't an early bird. In Columbus, Ohio, for example, in the field test of the QUBE system, people signed up for college credit and paid tuition to Ohio State University. Through QUBE Campus,they received books and materials and did their work at home at their TV sets, going to the campus only to take the final examination in the classroom. Others audited the same coursework via television; the QUBE console recorded students' selection of credit or non-credit participation.

Home storage of television lessons. The need for home video recording is lessened with cable television, because programming can be repeated as frequently as viewers need it. Still, with an active educational and/or personnel development channel at the local level, viewers could use home video recording to record and store lessons for later use in boning up for exams.

Bringing the world into the classroom and the classroom into the world. Why not capitalize productively and educationally on the video environment of children? One of the most effective change strategies ever used can help children to learn by coupling the unfamiliar (new skills and information to be learned) in the familiar (the television medium). A local cable company can wire every school in the district for cable and can wire every classroom to a cable converter, creating a social studies milieu that can be complimented with basic skills and knowledge via educational access and other cable channels. A community can have a variety of channels for these and other educational purposes, if the profession and the residents can show the cable company that education is a hot item in that community. In turn, cable can make education an even hotter item for the public and for the schools.

Special instructional programming for special students and teachers. Cable television can bring staff development, educational and other services to rural and remote areas where specialized training and educational services cannot be obtained. For students who are homebound or hospitalized, cable can help them keep up with their classmates. Cable TV can bring educational services to institutionalized children and help to bridge the gap between institution and community. This medium can also be used for direct delivery of classroom instruction to handicapped or gifted students, and can provide special classes and services not offered in schools or offered currently only at far greater expense. Cable programming can be delivered into the home to teach parents how to manage, train and teach their handicapped children. Parents of infants and young children can learn parenting skills via cable. Educators can participate in television committee meetings and conferences without leaving their desks. And you can imagine more and more.

Reaching the public through news, documentaries, discussion shows and public service announcements. The news from public education and higher education can reach the public via both the public access and educational channels of cable TV, and sometimes also through the municipal channel. This application of cable TV for education carries enormous weight and import in today's current events.

> Information conveyed to the public and the language (and medium) used to convey it have enormous influence on future events. Today, a growing and diverse number of people are claiming and shaping extensive information concerning education. Better articles and programming are proliferating through the mass media...
>
> That such negative reactions toward education can occur is indeed worth examining...We have got to learn about and act upon this changing situation while we are in it and even as it continues to change. In so doing, it is imperative that we communicate ourselves and our substance in ways that are riveting and real. Otherwise, we will quite soon find ourselves powerless about the very thing we suppose ourselves to be building: the American educational system. (Smith, 1981, p. 5).

A Few Early Innovators

Irvine Interactive Video System. Since 1974, the public schools in Irvine, California, have developed a unique two-way cable television network that dramatically illustrates the possibilities of cable for local educational programming. The program is based on the assumptions that a communication system must be interactive and that students, teachers and community people should actively participate both in operating the system and in creating programs.

The system makes use of two channels provided by the local cable company to link 25 schools, the public library, city hall, the community college, the University of California-Irvine and the local art museum. In this decentralized system, each school or other site can transmit its own video signal by means of inexpensive, portable equipment. Classes in two schools can see and hear each other simultaneously by transmitting over the two channels. Classes in other sites can listen in and interrupt to transmit if desired. Using a third public access channel, the entire community can receive the programs and interact by phone. The system is operated by teachers and students themselves; there is no central control room.

Students use the system to share their hobbies, expertise and special interests. On one day, a student presented a lesson on visual thinking, a group of students conducted a baseball talk show and a class of high school students taught dissecting to intermediate students. Students operate the system themselves, filling out program requests, planning instruction and operating cameras and microphones.

Teachers use the system for in-service training and exchanging ideas. Preservice student teachers from the university and community college observe master teachers in the classroom by video and then interact with the teacher immediately after the class. Teachers use the system for team teaching basic skills and to teach English as a Second Language to small groups in several schools simultaneously. Administrators use it for district conferences without leaving their buildings. Occasionally programs are directed at the general community. For example, school psychologists discuss guidance problems over the public access channel and take questions over the phone. Successful school programs are showcased periodically.

In Irvine, students and teachers are experiencing first-hand the potential of interactive video communication. The unique aspects of this system are its simplicity and the full two-way interaction. Together these two aspects allow everyone to participate in a creative and democratic way. The students in Irvine are gaining invaluable experience in the use of technology to enhance community values and education (Corey, 1982, Ritter, 1981).

Berks Community Television. In Reading, Pennsylvania, the city council conducts all its meetings on cable television. An interactive system allows citizens at any of three community sites to have two-way video contact with the council. Viewers at home can see both sides of the interaction on a split screen and can call in their comments by phone. In a recent budget hearing, over 50 citizens gave their input as compared to the average of two persons who showed up for previous meetings at City Hall. Each week on "Inside City Hall," the mayor or one of the council members appears to talk with citizens.

The interactive municipal channel was used recently after a controversial police raid on the local high school that resulted in 40 arrests. Superficial and sensational coverage of the event by the local commercial broadcast station did nothing to lessen tensions between police and students. A two-hour interactive program brought together representatives of the students, school administration, police and the general public to discuss the situation in depth. The program was so successful that the police department initiated a weekly program to talk with citizens. In Reading, the barriers to citizen participation in local government have been dramatically lowered (Richter, 1981).

Telidon in Ontario. Other countries such as Britain and Canada have led the way in the development of videotex systems. Videotex brings print and graphics to the television screen in response to users' specific requests for information. Schools throughout Ontario have access to the Telidon videotex system by cable, phone, standard broadcast or satellite transmission. Teachers and students use a key pad attached to the television to call up a series of menus in a branching structure until they find the information or learning program they want. The system includes print and graphic information resources such as maps and graphs and a database on computers in education. It also contains instructional programs, such as fractions, compound words and study units for literature. It contains a complete high school physics course for small districts without a physics teacher. Teachers identify information to be included in the system and, with technical assistance, author the instructional programs. The Education Ministry of Ontario currently plans to place microcomputers in all the schools to make the system more efficient by allowing downloading of programs (Cioni & Bowers, 1981).

Appalachian Community Service Network. The Appalachian Community Service Network (ACSN) is a programming company that provides adult education programs to cable companies in 43 states. The network was started in 1974 by the Appalachian Regional Commission, the National Air and Space Administration, and the National Institute of Education and is now an independent non-profit operation. Most new cable franchise bids are including this network as part of their package of educational services.

Approximately half of ACSN programming is composed of college credit courses on a variety of topics including computers, teacher preparation and special education. Arrangements are made with local colleges and community colleges to offer credit and provide tutorial support. Tuition is shared between the college and ACSN. Non-credit instructional programs are also offered (e.g., teenage drug abuse, clean air legislation and agricultural training). Most of their programs are purchased from telecourse producers in videotape form. They are always looking for new material (Morse, 1982).

Oakland, California. A program in Oakland demonstrates what can be accomplished when broadcasting students from a local college become involved in producing local educational programming. The media department of Laney College, the local community colleges, the public schools and the cable system have cooperated to create a new community cable channel. Media students under the direction of their instructor coordinate all the business and technical aspects of the system from scheduling and promotion to directing and operating the cameras.

The content is focused largely on credit courses from the community colleges. In addition, the public and students in the local schools receive television documentaries, local news and sports, and cultural programs from the museum and symphony. The media students gain invaluable experience and the community gains high quality local programming responsive to their needs (Dabney & Harrington, 1981).

Valley Vision Television. High school students in rural Colorado produce a weekly half-hour videotape for broadcast on the local public access channel. Students in this "Media Literacy" course could be seen in the back of a pickup truck with a porta-pak camera shooting footage for "Killer 82," a documentary on the state's most dangerous highway. They could also be seen working late at night editing and in class preparing scripts and listening to artists discuss "visual thinking." The course captured the imagination and energy of the students because it gave them a taste of the tremendous power of the media and a chance to participate in solving real community problems. In the process, they improved their writing and public speaking skills and learned to present diverse and controversial views objectively. Said one student, "I've learned that TV is more than just something you sit down and watch, it's sort of a tool" (Mann, 1981, pp. 14-15).

CENTEX. The Center for Excellence in Williamsburg, Virginia, has developed a two-way telecommunications system for the delivery of professional preservice and in-service training in education, special education and social services. The system makes use of cable and low-power broadcast on channels reserved for educational uses. The system has full two-way video capability so that instructors and students can see and hear each other. A variety of special education in-service courses have been offered with great success. Evaluation of the courses indicated that teachers reacted favorably to the two-way video format (Curtis, 1980).

Special Education/Teacher Update. This project at the University of Alabama televises courses on the education of the handicapped to hundreds of teachers in the Greater Birmingham area. Both cable and public broadcast television are used in delivering the courses. Teachers who wish to take the courses for credit register at the University and participate in the follow-up seminars and testing on campus. The system is especially suited to in-service because teachers can watch the programs at a variety of convenient times and need to come to campus only four or five times in the semester.

Videotaped courses developed around the country were gathered for use in these programs. One course currently being offerd, "Teaching Students with Special Needs: Secondary Level," was originally developed by the Maryland State Department of Education. The program is serving as a forum for evaluating courses developed elsewhere (Gear, 1982).

Working with the Technology

Responsive as many cable stations may be to educational programming, you obviously have to do more than show up at the studio with your lecture in hand. You need to understand something of the production technology, learn how to transpose instructional techniques for the visual medium, experience the interposition of the studio crew and cameras between the originator and the final product, and deal with other variables that characterize telecommunications. None of this is very difficult to master. Once you have mastered it, you will find that your entire approach to instruction has been revolutionalized and that you have become more creative in your original work place. The medium will change you as you change television.

Television as a Magnifying Glass

The most mundane picture or word that flashes across a television screen takes on new importance. Things that you would never walk across the street to see become important when they are shown (and watched) on television. Any topic will get more attention if it has been televised, and people can become temporary or permanent media heroes because they have appeared on television. Many items might never be read in a newspaper but, with five or ten seconds of television exposure, everybody in the country knows about them.

The power of the medium to magnify people and events can be a deleterious influence. The lesson to be learned is this: Plan carefully and anticipate how the medium will magnify what you do. Write and produce your television lesson or message as thoroughly and as carefully as you would prepare a professional publication. Although the publication may last forever, and your television presentation may be comparatively transient, you already know which one will have more immediate impact. A picture is truly worth a thousand words. Take care.

The Remote Audience

Although studio people and cameramen will be around while you make your television program, they will be attending to their work and not directly to you. Otherwise, no one else may be there--no nodding heads, no encouraging smiles, no reactions.

Educators play to audiences. In television the audience is not before us but, nonetheless, is there--and we must communicate with it, not lecture at it. If your delivery comes off as ONE/ON ONE, you will get a reaction out of your television audience. If your delivery is

ONE/ON TELEVISION, you will be too formal and stilted, and you may lose your audience. The secret is to be natural and conversational.

Think of the various television personalities and imagine those who appear most to you. These are the people who are "with you" when they deliver their message on the screen. They are natural; you can see it in their eyes. They are not thinking, "Oh, God, I'm on television." And if you have every wondered why some television personalities receive such high salaries, it's because they are masters at coming across personally. They really communicate with you.

Visual Teaching

In TV lingo, video pictures of people just talking are called "talking heads." We may get away with being talkingheads in the classroom or at the lectern or on the platform, but it won't work on television. In this medium, as a matter of fact, it should be possible for the viewer to turn off the sound and continue to receive the basic idea--from visuals--of the narration. Try it. Turn down the sound and watch the news. Write down what you think the stories are, and ask yourself how you deduce their content.

You will probably notice that visuals nearly always appear over the shoulder of the newcasters as they talk. These visuals have variety; they might be key words, graphs, charts, photos, art work. NBC News does a particularly good job with visuals; they cover business and the economy with striking and clear graphics that have tremendous impact.

Perhaps you already use many films and filmstrips in teaching, and in class you show them in their entirety. To do so on television would be to create a program within a program that destroys the progression and variation that make television interesting to viewers. You will need to edit films and film-strips in order to make them punctuate, illustrate and underscore your message. To learn how to transfer your information to a viewable and enjoyable package, start watching television in a new way--as a learner.

Creativity With Cameras

By watching television, you can also begin to identify different things that cameras are doing. Although you don't have to learn to use a television camera, the more you know about some of its capabilities, the more you can participate in planning for its use in your program. You might consider how some of the following camera shots, moves and special effects might enhance the kind of television program you might make:

Close-up--A camera shot of a person's head or head, neck and shoulders.
Angle shot--The camera is below the subject, so that the subject looms in the picture. Or the camera is above, looking down at the subject.
Reverse angle shot--A 180-degree switch in the camera's view from the preceding shot.
Crane shot--A very high angle shot while the camera is moving.
Single shot--Isolating one subject on camera.
Wide shot--Including a whole group on camera.
Tight shot--The subject fills the screen.
Full shot--All parts of a person or object are seen.
Pan--The camera shot is panoramic because the camera in motion swings from left to right or right to left.
Tilt--The camera moves up and down vertically.

Dolly shot--The camera moves around on its pedestal while shooting, continually changing its distance from the subject.
Zoom--Photographic enlargement, rather than a physical move by the camera, gives the impression that the camera has moved.
Stock shot--Footage previously shot by someone else and now part of the stock of a commercial film library (may include old movies, newsreels, scenic footage and so forth).
Cut--Transition from one scene to another or from one camera to another.
Dissolve--The control room fades the scene being shot by one camera and fades into what is being shot by a second.
Wipe--An incoming scene begins arriving from one direction and "wiping away" the existing scene.
Process shot--Live action in the foreground combined with a filmed scene in the background from a rear projection.
Split screen--The picture is in two parts (such as the two ends of a telephone conversation) or can be split into more than two parts.
Freeze frame--Suspending the action to highlight a dramatic point such as the look on someone's face at the end of a scene.
Montage--Series of brief scenes separated by slowing overlapping dissolves.

Musical entertainment shows and evening soaps like "Dallas" and "Dynasty" make use of a large number of these shots. Next time you're viewing, watch for these too.

The Influence of the Medium on the Message

According to Stover (1979), people who are writing about their work have much more contact with their readers (audience) than do people who bring their material to television. The writer has only to suffer the incursions of editors and typesetters, but on television, the technology and the crew are constantly interposed between the originator and the final product. These factors have an interpretive influence on the work.

A photograph is like a piece of fiction in this respect: The closer you are brought to the characters, the more interested you become. On television, communication is both auditory and visual, and both must be moderated and balanced in ways that will capture the interest of the viewer. The more visual clutter there is, the less the audience will attend to the message.

For example, a loud tie and plaid jacket will detract from the message of the speaker who is wearing them. For another example, in a wide shot everything on the set is in the picture--hands, feet, bodies, plants, furniture, other props. Because there is too much to look at, the emphasis is diffused. It is necessary to narrow what people see so that they can listen to what is being said. Visual images with impact, the ones that we remember, are not the crowd scenes from Cleopatra, but more likely the tight shot of Dustin Hoffman and Meryl Streep walking down the street in Kramer Versus Kramer.

Narrowing the focus means cutting out extraneous visual stimuli and bringing central people and objects into focus as the centerpiece of the entire television event. But a long sequence of nothing but head shots rapidly becomes dull. Therefore, a good cameraman will use different angles and distances, cutting and zooming, to sustain visual interest. Superimposed titles and well placed illustrative graphics also focus the viewer on the message. Cable TV people can also teach you how to talk in "30-second bursts" around which the camera shots and angles can vary.

The person who directs your production has an important interpretive role in calling the camera shots and otherwise arranging the style of the transmission. The production director's skill (or lack of it) will have particular influence on your message. A good director will

understand in advance what you want to say and do on television, and will help you with the subtleties of interpretation. A bad director may interpret too loosely, and some may be more interested in being artsy-craftsy and using novel video approaches that can, in themselves, distract.

Good television that really speaks has simplicity and uses the technology to reinforce the message, rather than interfere with it. You should rely on at least one person in charge to help you achieve this. There is a fine line between what almost works and what really works well. Cable television gives you the opportunity to achieve a production that works well because you will have more to do with it than with a commercial television production.

Here's Looking at YOU, Kid

Your dress, behavior and attitude can contribute or detract from your effectiveness as a television communicator. Your personal impact should be low on distracting qualities and high on credibility.

Gray, blue and pastel clothing photographs nicely on television, and simplicity is important. Frills and patterns distract, and the same is true of obvious and sparkling jewelry. The camera will accentuate heavy makeup, particularly vivid eye shadow. Check the dress and makeup that people use on morning shows like "Today" and the evening news programs. (It's interesting that Dan Rather's viewer ratings moved up when he began to wear a sweater, which apparently softened his appearance in a favorable way.)

Your appearance will be improved if you avoid quick hand and body movements. Also avoid the temptation to look at yourself in the monitor. Try not to hurry, and use pauses to punctuate and emphasize your presentation.

Once you are dressed and moving properly, the rest of it is credibility. According to Sherwood (1981), "credibility occurs when the Seven "C's" are summarized as follows:

Caring--People listen to other people who care about what they say, and caring is hard to fake. If you are committed to your work, that commitment will work for you as a communicator.

Confidence--Don't be intimidated. You are the expert. Television is your opportunity to reach hundreds or thousands of people you might otherwise never reach.

Concentration--Keep your mind on what you are doing, and this in itself will take your mind off studio distractions.

Control--Remember that you, and only you, are in control of the content and communication of your program. The cameras the other technology are controlled elsewhere; learn to ignore them and to control your own part of the telecast.

Comfort--The space before the camera, the chair at the desk, the materials in your hands--these are yours. Be at home with your setting and act as if this is a place where you naturally belong. The television apparatus is coming into your turf.

Conversation--Don't make a speech--Talk. Have a conversation as you might with a colleague or neighbor.

Conciseness--Say what's important and don't waste words. Don't ramble. Being concise is being well prepared.

Remember that television will magnify what you do. If that knowledge makes you uptight, then the camera will only magnify your fear. Allow the camera, instead, to magnify your message, which is what will happen if you can become relaxed, at home and natural within the television medium.

Starting Out

The cable opportunity is easy to take advantage of, and many local stations will help you to do it. For example, Warner Amex stations are reaching out to bring their communities right into the studio by means of training and lots of production help. Houston Cable TV (a Warner Amex station) is planning training seminars for the public, as well as a television production course for everyone who is interested, including school students. Participants will learn how to write, format and shoot television programming; how to operate certain equipment; essentials of production, direction, switching, blocking out shots, and many other how-to's of the telecommunications profession. People who successfully complete the course will be certified to return to the station to use all of its facilities and equipment. Houston TV will also help untrained people to get their particular programs on the air, but, because a TV station will never have the time to produce everyone's idea, the best approach is for educators to participate in all the training they can obtain.

To explore the possibilities of cable television for your educational purposes, call the Public Relations Manager or Community Relations Manager of your nearest cable television station and arrange an appointment. If you are representing an entire school district for district-wide educational TV service, then your best bet is to contact the General Manager of the station first.

These people will of course, want to hear your programming ideas, but other factors are also important to them. They will want to know that you are in their broadcast area; how many schools or students or teachers are in the district (depending on the content and target of your program); how many of these target audience members are on their cable system and what sort of audience you might predict for your programming.

Quality and effectiveness will not be overlooked by many stations. It is possible that stations may ask a school district, college or university to perform referral and evaluation functions. Thus, cable TV can serve as conduit and can provide some guarantees of the quality and appropriateness of production, while the educational community can assume responsibility for quality, appropriateness and continuity of content.

Conclusion: Do What You Are Afraid To Do

More than 97 percent of American families own at least one television set--more families than have kitchen stoves or refrigerators (Bronfeld, 1981). Today more than 23 million families subscribe to a cable television service, and this number should increase to more than 47 million by 1989 (Kagan, 1982), and continue growing. Television is a familiar medium that people pay attention to. It has great power and scope. Cable makes television convenient and accessible to every educational purpose, free of charge. If we do not take this chance, we are fools.

Television is an educational medium and always has been. It has a profound influence on what people learn and what they think. Through cable television, the profession of education can begin to have a profound influence on television. Education can participate in shaping television. Television will, in turn, surely shape and improve education--and educators.

In the process of successful innovation,
The greatest change is in the change agent

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